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THE IRON AGE

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MAY 4, 1939

ESTABLISHED 1855 Vol. 143, No. 18

All We Need Is a Little Quiet

AFTER seven years of "excursions and alarms" American business, or what is left of it, ought to be calloused and case hardened and impervious to emergencies. One would think that it should be, but it isn't.

During six of these seven years of manufactured emergency, business was kept worrying about things at home. About taxes, depressions, labor troubles, increasing costs and shrinking profits, if any. But that did not take in enough territory, so we have recently taken on the additional job of worrying about things abroad.

So now the thing that is holding business back is the "war scare." Well, probably when that finally releases its hold on us, some other fear will take its place. Just one thing after another.

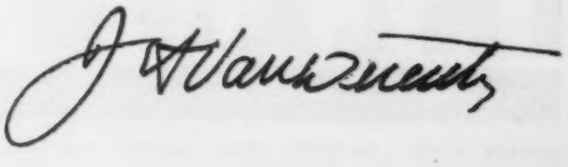
It is too bad that such things can hold business back and particularly business that is "rarin' to go." And that is the state of American business just now. "Rarin' to go" but afraid to stick its neck out.

I am told by business executives in a number of lines that every time there are a few days of "silence" in official quarters abroad and at home, business immediately picks up. But the silence does not last long enough.

All that we need now for a business revival is a few weeks of quiet from the official noise-makers and face-makers of the world. We won't even insist on "appeasement" from Washington. Just give us peace and quiet and watch us go!

It reminds me of the story of those big bullfrogs that used to keep the inhabitants of their neighborhood awake all night, night after night, with their croaking. First one big blustering bull would fill his lungs and explode in a mighty "ka-ruung" to indicate his supremacy. Then another neighbor of his would try to outdo him with a hefty "ka-roong," meaning "you and me, too, brother." And then from across the pond would come the ear splitting "ka-riing" of a third bull, inquiring "Oh, yeah, you two and who else?"

And so it went for years and years, with no peace and quiet for the neighborhood until one happy night the three bulls exploded from trying to outdo each other. After which there was peace, quiet and prosperity!



IT SHALL BE DONE



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Carburizing Today

METHODS, STEELS, TREATMENTS

By GORDON T. WILLIAMS
Chief Metallurgist, Cleveland Tractor Co.

IN this the first section of a two-part article, the author describes carburizing procedure as of today, the equipment used, the various techniques employed, and the metallurgical and physical characteristics of carburized articles.

THE fundamentally simple operations of case-hardening have been widely used for so many years that the process is as firmly entrenched in modern practice as any heat treating method. Such is the oldest, and, until recently, the only method of producing parts with a hard, wear or load-resisting surface and an interior of less hard, tougher steel. And even though obsolescence has been claimed often, "carburizing and hardening" today more than ever before is being demanded on a tremendous variety of parts.

Increasing application is being made of induction hardening, and of steels so shallow hardening that normal heat treating will give a sharp hardness differential between surface and interior. Furthermore, studies and developments of recent years have clarified and directed thinking regarding all phases of the case hardening process, and its future use appears certain to be even greater than now.

This article is intended to give a general survey of case hardening procedure, including selection of carburizing method and performance thereof, selection of steel, and selection of hardening treatment. While a book ten times as long would by no means exhaust the subject, it is the author's hope that a simple, coherent basis may be presented from which a proper utilization of the advantages and superiorities of present practice in carburizing and hardening may follow.

In accordance with definitions set forth in the A.S.M. Metals Handbook, carburization and case hardening are differentiated as follows:

Carburization (cementation)—Adding carbon to iron base alloys by heating the metal below its melting point in contact with carbonaceous solids, liquids, or gases.

Case hardening—Carburizing, and subsequent hardening by suitable heat-treatment, all or part of the surface portions of a piece of iron base alloy.

Why case harden? There are two general reasons why a hard, high-carbon surface may be desired in a given instance. The first is that the high surface hardness may add considerably to the normal length of life under wear; hardness is usually the best means of combating abrasive conditions and the hardened high-carbon surface will have high mineralogical hardness, i.e., high resistance to scratching or indentation. The second reason is that high hardness here connotes high tensile strength, and thus improved resistance to mechanical loads at or on the surface is had. This high surface hardness might be attained by the use of high-carbon steels which would harden more or less throughout; but, such a piece would have poor resistance to notch propagation, i.e., be "brittle," the sub-surface metal having insufficient ductility to permit slight yielding so that otherwise destructive stresses might be distributed and made harmless. Using a steel which after normal treatment would toughen but not develop sufficient hardness, the carburizing procedure forms a high-carbon zone of desired depth at the surface and permits this case to be hardened fully while the core, being only toughened,

will give resistance to notch propagation, or, in simpler words, the piece is less brittle than as though hard all the way through.

The present ever increasing use of case hardening may be attributed to three factors: increasing demands of mechanical design, calling for better stress-resisting parts; constant improvements in steels to be carburized with less distortion and uniformly high properties; and developments in accuracy of carburizing and control of case characteristics. Surface hardening by localized heating of steels which if normally treated would harden fully with concurrent embrittlement and warpage, is being successfully carried out by two processes, electric high frequency induction heating and flame hardening by oxy-acetylene torches. Important as these are, they have not yet seriously encroached on the field of case hardening.

Basis for Survey:—It must be borne in mind at all times that a carburized piece is duplex metal, having two critical ranges and differing responses to treatment. The selection of steel type to be used, case depth required, and heat treatment to provide best properties must be made with this in mind—all these factors must be simultaneously considered, since a change in one will usually demand a compensating change in the others. The discussion which follows will approach the subject from four points of view, those of *carburization, case depth, heat treatment,* and *steel selection,* but there will necessarily be much overlapping and repetition.

The Carburizing Process: — As stated in the definition above, the object in carburizing is to have carbon enter the steel, from the carburizing agent, in quantity and manner preferred. All carburizing is considered to be the result of gas reactions, regardless of whether the carbon source is gas, liquid, or solid, but the latter classifications are useful in discussing methods. The actual mechanism of carbon combination with iron will not be argued, it being a debatable subject but not of present moment. It will be assumed that carbon is present in either the necessary gaseous form or in the metal as iron carbide.

Since carburizing action is almost negligible below 1500 deg., and equipment is short lived above 1800 deg., these temperatures define the range commonly employed.

Characteristics of the Carburized Case:—A typical case, unhardened, is

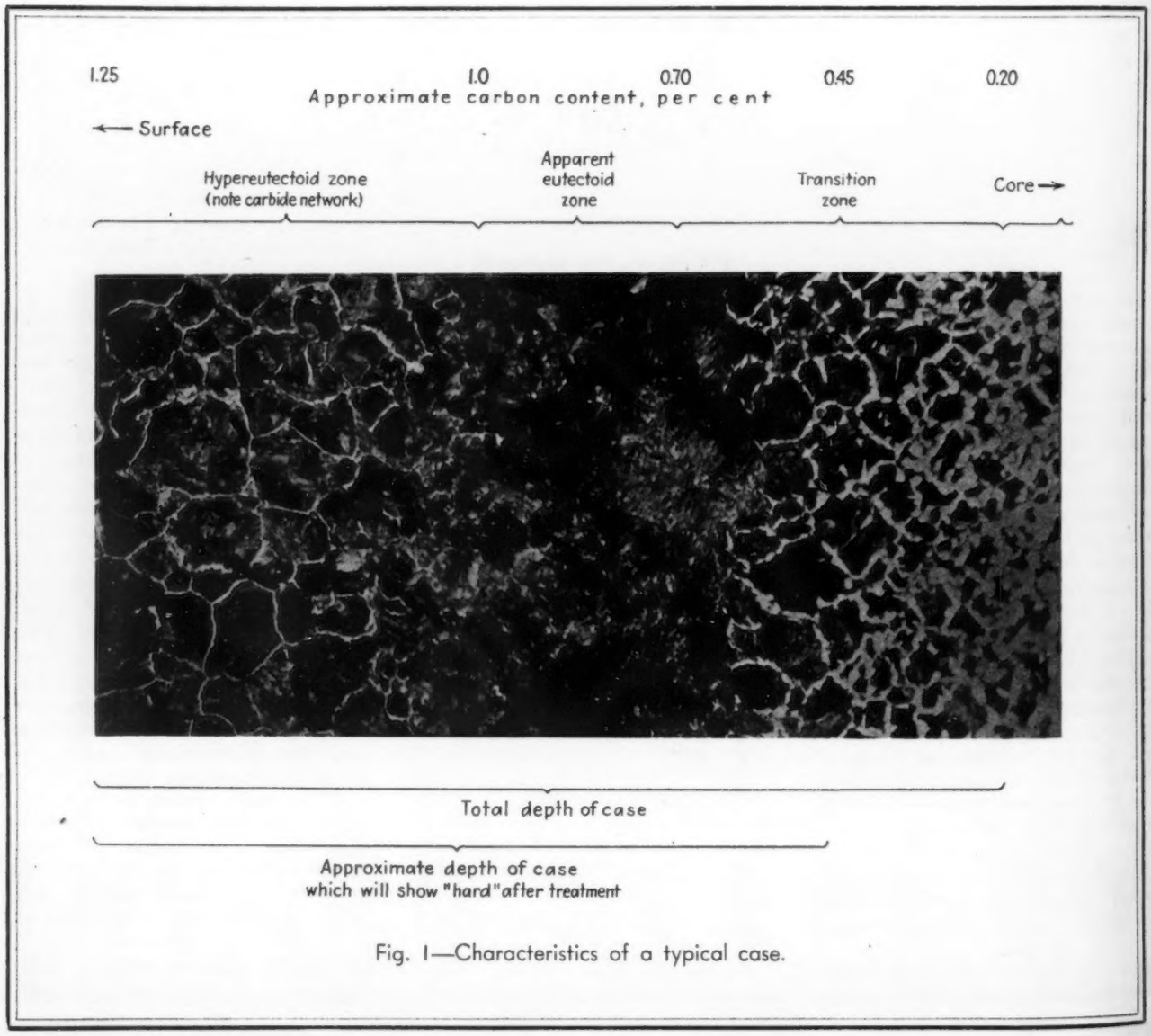
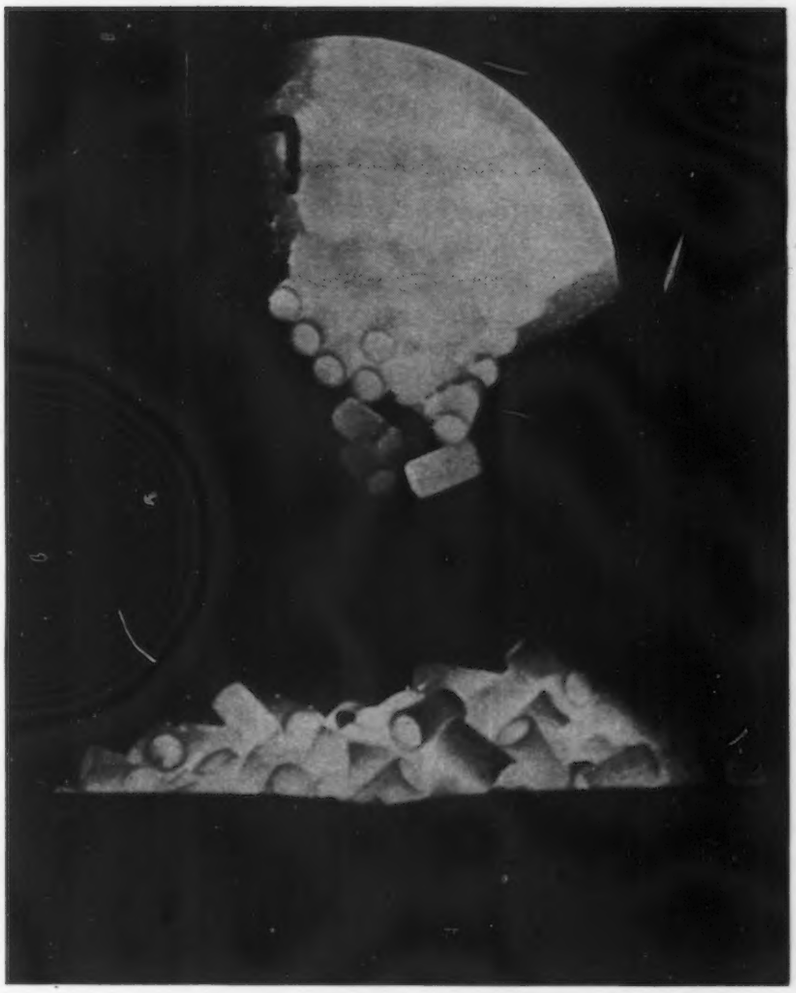


Fig. 1—Characteristics of a typical case.

shown in Fig. 1. The low-carbon core is apparent, as is the increasing carbon content as the surface is approached. The "transition zone" from original steel to the high carbon, fully hardenable case, the eutectoid zone where neither excess ferrite nor cementite is present, and the hypereutectoid zone at the surface are designated, as well as the approximate carbon content. Of prime importance are the depth of hardenable case (usually considered to end at about 0.50 carbon), the smooth gradation of carbon content so that each zone is well knit with the adjacent ones, and the amount of excess cementite in the hypereutectoid zone which affects the type of heat treatment that must be used. This excess carbide is, as may be seen, in the form of a network in the grain boundaries, and, being brittle, must be reformed if good case toughness is desired. All carburized cases in the unhardened condition will resemble Fig. 1, although the hypereutectoid zone may be decreased or eliminated by proper carburizing.

There are two simple, important phases of carburization, the absorption of carbon by the steel, and the diffusion of this absorbed carbon into the steel. Carbon absorption increases with increasing temperature so that a greater amount of carbon enters the steel at higher than at lower temperatures. The rate of diffusion of this carbon from the surface inward changes even more markedly with temperatures, so that, in the lower range of useful carburizing temperatures, the carbon absorbed will not diffuse rapidly, and surface carbon content will build up to a surprising degree (well over 3 per cent carbon has been found in the extreme surface layer of steel carburized at 1500 deg. F.), but the case depth attained in a given time will be slight. At high temperatures the reverse will be found—carbon absorption will be high in total quantity, but the maximum carbon will be lower, perhaps 1 per cent at 1800 deg., because of the high rate of diffusion into the steel; case depth obtained in a given time will thus be large.

Carbon absorption, then, depends on temperature and available supply of active carburizing medium. At a given temperature, there is a definite maximum value which will not be exceeded regardless of activity or quantity of carburizing agent, but absorption less than the maximum may often occur, due to insufficient carburizing medium, this condition being either deliberately produced to lower the maximum carbon attained, or accidentally, as with spent compound or inadequate gas supply to the work surface.



ROTARY retort carburizer dumping at night. Photo by Silliman at Cleveland Tractor Co.

Diffusion of carbon once combined with the iron follows the general laws of diffusion; the rate of penetration is increased with temperature and reduced as carbon gradient ("pressure" of the higher carbon zones tending to drive carbon toward the lower) decreases; it is also affected by steel composition, but this is relatively a lesser effect usually. Thus, reducing useful carbon supply to the steel will tend to lower the surface carbon and at the same time somewhat reduce the rate of penetration, and, on the contrary, a high-carbon surface layer will continue to cause case depth increase, even though no more carbon is being added. Frequent advantage is taken of this latter principle in gas carburizing, as will be noted later. Since decreased gradient or "head" of carbon reduces diffusion rate, it is clear why average rate of penetration is lower as depth of case is increased; at a given temperature the rate for the first hour will be high, decreasing quickly to a lower value as time proceeds.

Carburizing Rates:—The maximum rate of penetration is thus seen to depend on maximum absorption at a given temperature, plus the diffusion which will ensue. In Fig. 2 curves developed by Schlumpf show case depth found after any given time at several temperatures. The case depths were measured on fractured hardened specimens. Carburizing was performed in natural gas (almost pure methane) and in the writer's experience these curves represent about the maximum to be obtained, since an ample supply of active carburizing agent was always present. Penetrations ap-

preciably below those shown are an indication of weak or insufficient active carburizer, or a temperature lower than expected. It is interesting to note that replotting these curves in log-log coordinates gives a series of straight parallel lines, indicating conformity to a basic law.

Method of Case Depth Measurement:—Such measurement is a frequent source of confusion; the cases predicted in Fig. 2 include the hard portion (above 0.45 carbon) only. As a general rule this method of measurement is the most useful since the depth of the desired case is considered. However many ways are used to describe or specify case depth, and any is satisfactory if fully understood.

Carburizing Methods:—As indicated above, all carburization is believed to be the result of gas action. The source and continued activation of this gas determines the difference between the three general methods of carburizing. Chemical reactions will be referred to only incidentally here; for more elaborate discussions the A.S.M. Carburizing Symposium (1937) and the 1939 A.S.M. Metals Handbook should be consulted.

Solid Compounds: — Historically the most important method, carburizing by heating steel in close contact with solid compounds, is still the most widely used. These compounds usually are made up of a charcoal and coke base, impregnated or coated with "energizers," usually barium, calcium, and sodium carbonates, suitably bound together. Charcoal alone is a very weak carburizer; the energizers accelerate the formation of actively carburizing gases, and assist in the reactivation of spent gases after they have delivered their available carbon to the steel surfaces. If total energizer content is above 8 per cent, maximum activity is ordinarily had. Since handling of compound causes it to break up into fragments, and the heavy chemicals are loosened, the powder lost in screening compound contains much energizer; therefore new carburizing compound is usually made up to carry about 15 per cent total energizers, and the normal additions of new compound to replace shrinkage due to burning and powdering (usually near 20 per cent) will keep the chemical content up to the necessary level.

If the steel parts are packed so they are covered with such a compound in a suitable container and heated to the selected temperature, carburizing will proceed in accordance with Fig. 2. But note that carburizing compounds are excellent insulators, and boxes usually are large, so that interiors thereof do not come to heat as rapidly as might be thought from watching an external temperature indicator. Thus the rate of carburizing in compound has often been thought to be less than in gas, when the difference actually was in time at heat.

Large irregularities may occur, in one box and in furnace loads of boxes, in time of coming to heat; this means a variety of case depths in one load, and this occurrence has been an important factor in stimulating gas carburizing. Of course, a fundamental requirement is uniformity of furnace temperature if any approach to case depth uniformity is to be had; colder portions of a furnace will result in both longer time of coming up to heat and lower penetration rate at heat. No possible means of arriving at uniform furnace and work temperature should ever be neglected.

Continuous furnaces, in which box after box is carried through the same heating cycle, give greatly improved uniformity, particularly if thin, closely conforming containers are used so that lost heat and time due to insulating effect of compound are held to a minimum. It is amazing how little compound is needed to provide for carburizing. Roush and Dames in discussion of carburizing container design state that 0.01 lb. of compound per sq. in. of surface is ample. Brief consideration will verify this; a case depth of 1/16 in. means an absorption of an average of 0.50 per cent carbon by weight or 0.00009 lb. per sq. in., a truly minute amount! Closely conforming containers reduce tremendously the time and cost of heating, improve the uniformity of results, and decrease warpage, but usually require a large investment in heat resisting alloy. Only in those plants where large volumes of duplicate parts are carburized can economical advantage be taken of the possibilities of such special, individual containers. This is also usually true of continuous furnaces, which are not adaptable to wide variations in size of work or case depth specifications from hour to hour.

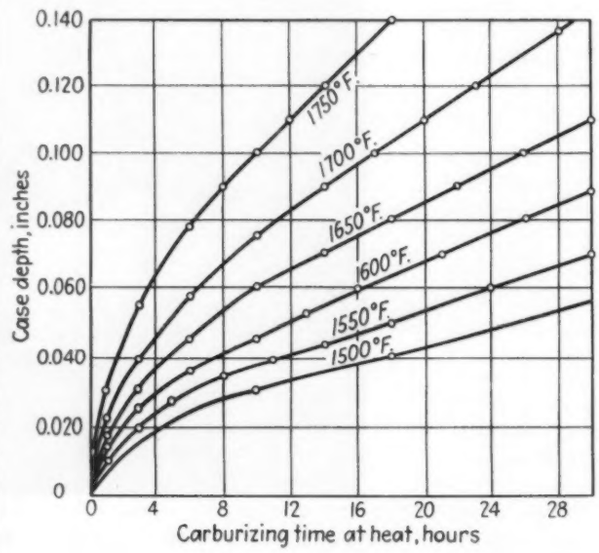


Fig. 2 — Time-depth penetration chart (Schlumpf).

Although carburizing by solid compounds is the oldest, best known, and most fool-proof method (it can hardly fail entirely), it is expected to be a dirty process with handling of compound at start and finish, and is usually the most expensive method, because of the lost time, heat, and compound. Further, modern hardening practice very often requires direct quenching at the end of the carburizing cycle; this is fairly difficult when the work is packed in boxes, and the hot compound tends to make it an un-

pleasant job. For these reasons practically all recent installations have been of gas carburizing equipment.

Carbon-supplying activity of the compound, and thus maximum carbon of the case at a given temperature, cannot be regulated over any range with these solids. With a given compound, little control can be exerted over the type of case produced.

Any case depth may be achieved by compound carburizing, but when very thin cases are sought, it is difficult to know when to start counting the short time required, and local variations in time at heat are very significant. Longer times at heat tend to make these differences moderate, and it is in this range that compound is usually used. When extreme case depths are sought, loss of activity due to compound becoming spent may result in such lowered rate of maximum carbon that cooling and repacking with fresh compound for an additional carburizing period may be necessary.

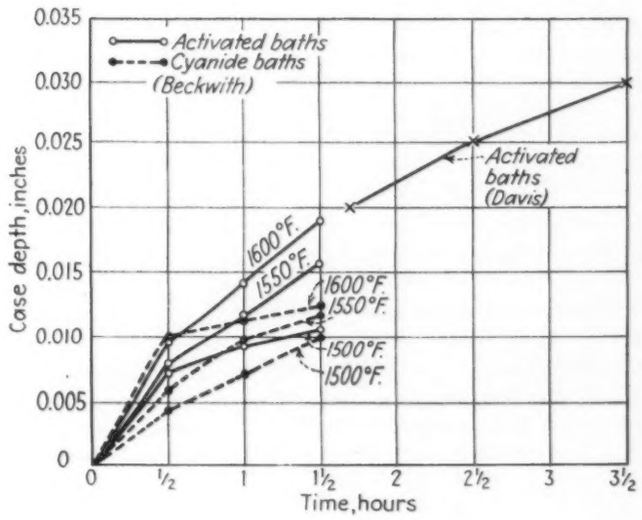


Fig. 3 — Depth of case with cyanide and activated baths (Beckwith, A.S.M. Carburizing Symposium, and Davis, A.S.M. Metals Handbook, 1939. Davis bath at 1650 deg. F.)

Gas Carburizing:—Since carburization depends ultimately on gas action, obviously gases may be used as the original source of carbon. Many gases have been found to be highly effective suppliers of available carbon, and their employment as direct carburizers is of great modern importance. The large majority of carburizing furnace installations in recent years utilize gaseous media. Elimination of the solid compound and its insulating effect has given economy in time and improvement in uniformity. Instead of boxes in which the work is packed, the work, suitably supported, if necessary by trays and fixtures, is placed in a large heated retort or muffle into which the carburizing gas is introduced and kept isolated from outside air or furnace gases.

Furnace equipment of three fundamental types is in use, as follows: rotating retort, fan agitated stationary retort, and non-fan agitated stationary retort. These may be heated by any means that will give good temperature distribution. When the retort is rotated, a good uniformity of temperature is assured and all pieces are frequently exposed to the fresh carburizing gas. Tumbling, of course, causes some marking of work and is often not permissible. In the other two types, the difference is as to method of insuring gas circulation. If a fan is used, the gas is given turbulence thereby and spent or stale gas blown away from the work surfaces. If a fan is not used, several inlets may be required, as well as greater gas flow, to provide proper agitation of gas.

Useful Gases:—A wide variety of gases has been successfully used in carburizing; practically all in current commercial use are hydrocarbons such as natural gas, propane, or heavier similar compounds which may be liquid at room temperature but are readily vaporized in the furnace muffle. All of these contain sufficient carbon that carburizing at the minimum rate may be achieved, but this very same over-abundance may cause trouble, as shown below.

Soot Regulation:—In order to maintain maximum activity, the steel surfaces must be kept supplied with effective gas, and the spent gas layer around the parts must be removed or invigorated. This demands, therefore, a certain turbulence or rate of flow of gas past the steel surfaces. Such a flow may be had by use of a large volume of fresh, carburizing gas, or by forced circulation by a fan. If the latter is used, but small additions of raw gas are required. If, however, high flow of gas must be used to get sustained activity, then the over-abundance of carbon in the gas will ordinarily lead to heavy deposits of carbon as soot. If the work is being tumbled, as in a rotating retort, this cannot ordinarily build up to any extent on the steel surfaces. Otherwise the deposits will often be so great that the steel is effectively blanketed and carburizing action interfered with.

Consequently it is usual today in gas carburizing (in the absence of tumbling or fan agitation) to so dilute the active gas by mixing with the desired proportion of a relatively inactive gas that high flow rates may be used without heavy soot deposits being formed. Air is often used as a diluent; it is free and easily used, but is not too effective in soot control. Incompletely burnt gas prepared in an auxiliary unit is much used and is fairly effective. The same type of gas may be treated by passing it through hot charcoal, giving a gas of very satisfactory properties as a diluent. Spent gas leaving the carburizing chamber is obviously largely broken down and is another useful and effective dilution medium. "City gas" is sometimes unsatisfactory as a carburizing gas due to irregularity and insufficient active portion, but is often very useful when of the proper "weakness" as direct carburizer or as dilution gas. All these are in frequent use and their actions are discussed in detail in the A.S.M. Carburizing Symposium.

Regulation of Activity:—Since the above gases all provide an abundance of available carbon, the maximum case produced will have a high surface carbon content, often higher than desired. The dilution employed for soot control may be carried further to reduce the

carbon-supplying activity of the gas so that reduced surface carbon content is obtained, and the hypereutectoid zone reduced or eliminated. This effect is probably as important a reason as soot control for dilution in current practice. By proper dilution to produce a carburizing gas of suitable activity, the maximum carbon content of the case may be reduced from, say, 1.30 per cent (at 1700 deg. in straight natural gas), to 0.95 per cent to 1.05 per cent, or even lower if desired, and with a simultaneous improvement in cleanliness of work. Also, life of heat-resisting alloy will be lengthened. The writer is convinced that excessive soot deposition is a very important cause of premature alloy failure.

A variation of the simple dilution procedure which is coming into increasing use consists of the periodic admission of regulated quantities of the raw, rich gas, followed by periods of no-gas admission, during which the carburizing atmosphere gradually becomes spent. Then the raw gas injection serves to reinvigorate this spent gas to the desired degree. Thus the spent gas is used as a diluent, as described above. In carburizing of gears in the plant with which the author is connected, batch-type horizontal gas carburizers are used. Straight natural gas required a flow of at least 80 cu. ft. per hr. to give uniform case, but this led to high surface carbon content and heavy soot deposition. Current practice is to admit a high flow of natural gas for approximately one minute, followed by several minutes of no gas injection. The results obtained by this procedure are very satisfactory, soot being very low, maximum carbon about 1.05 per cent, carburizing gas consumption totaling about 40 cu. ft. per hr. and no auxiliary gas being needed. Such cycles have been used in the past in a variety of ways and offer many advantages in batch-type gas carburizing operations.

Regulation of Maximum Carbon:—This regulation may easily be performed, as indicated above, by reducing the gas activity. Another method, feasible only with gas carburizing, depends on the continuing inward diffusion and leveling tendency of the carbon when no further carburizing agent is present. Thus, by simply shutting off the supply of active gas, the case penetration continues at very nearly the same rate for a long time, the surface carbon being steadily decreased. This method of carbon content control is widely used; the procedure of periodic injection of active gas, described above, is really a form of alternate carburizing and diffusion. As the "head" of carbon is lowered, of course, the rate of penetration must decrease, but during a diffusion period in which the surface carbon is reduced only slightly, as from 1.25 to 1.00 per cent, the case depth will continue to increase at nearly the normal rate.

Direct Quenching From Gas Carburizers:—Such quenching is easily performed, no packing material being present. Soot must be controlled, else heavy deposits will interfere with quenching. However, the ease of quenching direct has led to increasing use of gas carburizing prior to such treatment. An important phase of this lies in the ever-growing use of carburizing atmosphere in continuous furnaces used for heating automobile gears for hardening, a thin extremely hard surface layer being formed on standard oil-hardening materials. This will be referred to again in connection with selection of case depth.

Liquid Bath Carburizing:—The use of molten baths for surface hardening is in no sense a new process, but developments in recent years have caused such treatment to gain rapidly in importance. Cyanides have long been used for the production of thin, very hard cases, but attempts to produce depths of more than a few thousandths of an inch leads to rapid deterioration of the bath (high temperatures being used to increase penetration rate) plus a serious embrittlement due to high nitrogen content of the case. The modern liquid carburizing media consist principally of inactive carrier salts plus cyanides, but also include special materials added to accelerate the production of available carbon, to reduce nitrogen absorption, and to retard bath deterioration. In such a molten carburizing bath, case depths of up to 0.030 in. are readily produced and a very satisfactory type of case is obtained.

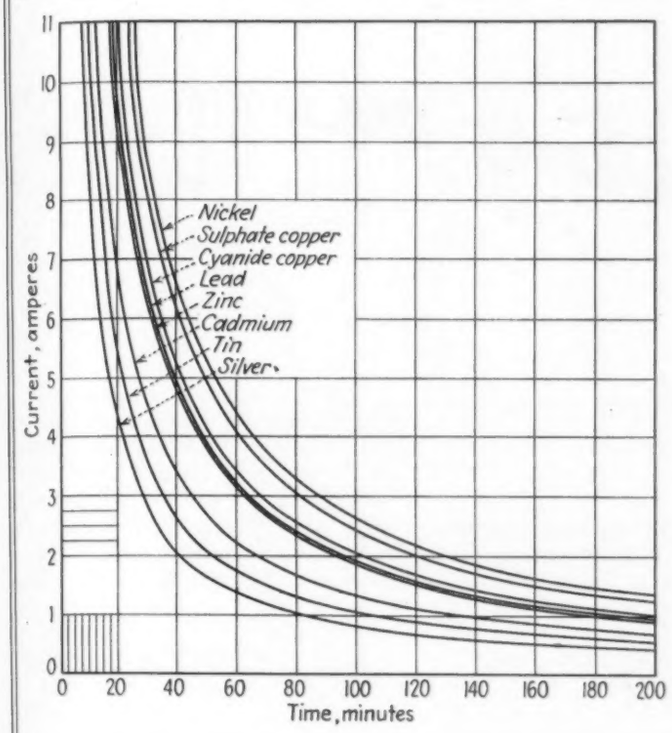
Since uniformity of temperature is usually quite good in a molten salt bath, a good uniformity of case depth is to be expected. Penetration rates appear to follow the curve of Fig. 2; in Fig. 3 are shown curves for case depth, taken from the paper by Beckwith in the A.S.M. Carburizing Symposium. These curves seem to cover all types of carburizing baths of full activity, since there is a maximum which cannot be exceeded. The time the work comes to heat is easily estimated, so that desired case depth may be rather precisely controlled. It is for this reason especially that use of such carburizing baths is increasing. Small, thin parts requiring hard surface and good toughness necessitate closely controlled case depth and type, and these demands are nicely met by the molten media.

Work is direct-quenched from the pot into water or oil almost universally. It was formerly difficult to clean liquid carburized work after oil quenching, due to water-insolubility of the base salts used, but in recent years many baths have been developed which wash freely to a clean surface after oil quenching. This has been done largely by reduction or elimination of the insoluble portion of the constituents. Water quenching offers no difficulties in any event, the adherent salt being "exploded" off in the quench.

Stability of bath activity has been improved in the currently available liquid carburizers, so that discarding of spent salt is not often required, the normal drag-out replacement sufficing to maintain high carburizing activity. When long heats with little drag-out are employed, it may be necessary periodically to bail out a portion of the bath, to permit addition of sufficient fresh salt. For such operations certain makers offer a concentrated energizer, the bath thus consisting of a base salt plus separate energizer, while most baths are sold as a single component containing the required proportion of active agent. In this latter type, baths of greater or less ratio of energizer are usually offered to meet varying conditions, the active content regulating the price of the salt as supplied.

The liquid carburizing baths find their greatest employment in the production of case depths around 0.010 in. to 0.015 in., but, as mentioned previously, are useful up to 0.030 in. or even more in some instances. Work is almost invariably direct quenched, followed by a tempering treatment if necessary. An oil quench is being used for very thin pieces, when satisfactory hardening will occur, or for alloy steels, while water or even caustic or brine solutions are used for heavier parts of carbon steel. The uniformity of heating and of case depth, plus the simplicity of treatment, will result in low distortion.

Ed Note:—The second and last section of this article will appear shortly, and will deal with the selection of steel to be carburized and the selection of the case depth to be used.



ELECTRODEPOSITION CHART

Time for brush plating an area of 100 sq. in. with a thickness of .00025 (1/4 thousandth) in.

Approximate Amperes Drawn by Various Anodes Using 6 Volts—

Solution	Spiral Anode	1½ in. Anode	2½ in. Anode	4 in. Anode
Cadmium	1	3	7	9
Copper (Cy.)	1½	2½	5	6
Copper (Sul.)	1½	3	6	7
Lead	2	4	8	10
Nickel	1½	2½	5	7
Silver	1	2	4	5½
Tin (4 V.)	1½	2½	5	7
Zinc	2	3½	8	10

Brass and Bronze: same as Cyanide Copper.

Take amperage (left side) read down (bottom) to minutes:

Example: A 2½ in. anode will deposit from the metalline solution of tin 0.00025 in. over an area of 100 sq. in. in approx. 20 min.—10 sq. in. in 2 min.
With 1½ in. anode, 100 sq. in. in 40 min.—10 sq. in. in 4 min.
Double or divide for *thicker* or *thinner* deposits.
Calculated on use of brush 75 per cent of total time.

BRUSH PLATING

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A SURFACE treatment and finishing of metals, either a decorative or protective plating, are accomplished practically and efficiently by the portable brush electroplating process, according to makers of the equipment, Portable Plating & Equipment Co., 1000 South Michigan Avenue, Chicago.

It is said that over 500 of these installations are now in use. Brush plating as developed by this company is said to be comparable to the principle of the tank immersion method *with the exception* that the solution, made up in *plastic form,* is applied with a special type brush and anode. Plating takes place *only* where the brush is directed and the longer the brush is applied with sufficient solution, the thicker the deposit becomes.

By increasing the size of the anode in the brush, a greater current efficiency is obtained; consequently, a more rapid deposition of metal. All workable sizes of pure metal anodes are available. The plastic plating solutions do not deteriorate with age. They are always ready for use and can be salvaged and used again.

The plating efficiency of the brush process is said to be remarkably high due to the proximity of the anode in the brush to the base metal and the simple control and continual agitation of the plating compound during the brushing. This continual movement, wiping away any accumulated film occasioned by the chemical and physical characteristics of the base metal, acts to insure an unusual bond between the two metals, resulting in a very dense, uniform and nonporous deposit.

The essential requirements for satisfactory results with brush electroplating are personal efficiency of the operator and attention to instructions. An average workman is said to be able to learn the correct method of plating in a few hours. The time required to plate a definite thickness of any of the more common metals, with various anodes and at various current values, is shown in the accompanying illustration.

The portability of the unit is a definite convenience. It permits plating on articles and equipment without dismantling and reassembling. The equipment complete consists of a specially designed and constructed power supply unit, correct cleaning agents, plastic plating solutions, special type brushes and anodes. The power unit operates wherever there is an a.c. outlet, or on d.c. outlets through the use of a converter.

As examples of the use of this equipment, note that utility companies find it valuable for applying silver deposits on bus bars and switch gear of all kinds to eliminate copper corrosion and for higher electrical conductivity. Manufacturing companies use it for applying zinc over welded seams where the protective coatings have been burned off or for all types of anti-corrosive deposits on vats, tanks and other surfaces. Railroads use it for decorative plating on equipment and fixtures without dismantling; anti-corrosive deposits on metal surfaces, especially cadmium on locomotive driving rods. Users of press steel dies use it for applying hard nickel cobalt deposits on large or small surfaces. Automobile service stations have innumerable uses for brush plating. Towns and cities find it valuable, where no tank plating facilities are available. Industrial art schools find it valuable for practical work and instruction, and service companies use the equipment for replating metal window strips, signs, and store fronts.

Some Observations on— 18-4-1

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COLD SHORTNESS: Cold shortness is the term applied to steel which is brittle when cold. In the several cases to follow, the term cold short will refer specifically to several heats of 18-4-1 high speed steel which when stamped with steel roller stamps under a hydraulic press developed cracks in the roots of the letters —such is a very practical example of cold brittleness or cold shortness. This method of stamping is quite uniform as regards the pressure applied, and the steel is not subjected to a sharp blow. With the exception of the steel made from the two heats which showed cold brittleness, the development of cracks by this method of stamping is practically unknown.

The analyses of two heats of steel in which cold brittleness was indicated are shown in Table II. With respect to the steels shown, heat R was mildly cold short, the number of cracked blanks being few. Heat S was abnormally cold short, 40 per cent of the blanks processed being cracked.

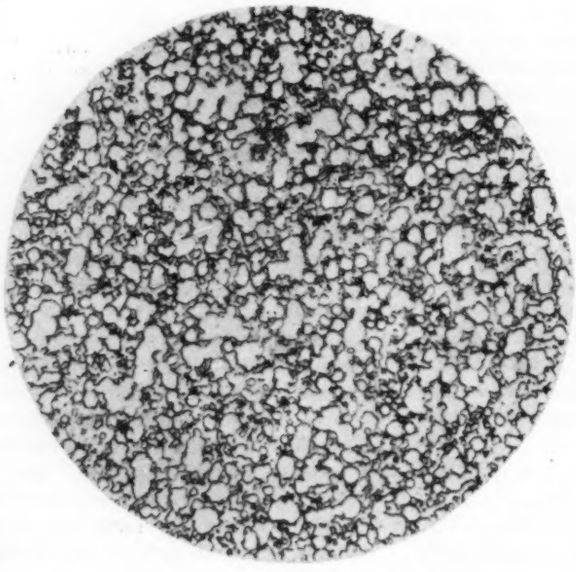
Cold shortness, which is rarely found in high speed steel, has been attributed to arsenic or arsenic and phosphorus, the latter being additive with arsenic. Arsenic to the extent of 0.05 per cent is considered sufficient to make high speed steel cold short. The combined arsenic and phosphorus of heat R equals 0.036 per cent and of heat S, the arsenic and phosphorus total 0.06 per cent. Material from heat R showed a normal response to heat treatment and normal annealed and treated structures. Material from heat S was definitely sluggish in its response to heat treatment and showed poor microstructures in both the annealed and heat treated conditions.

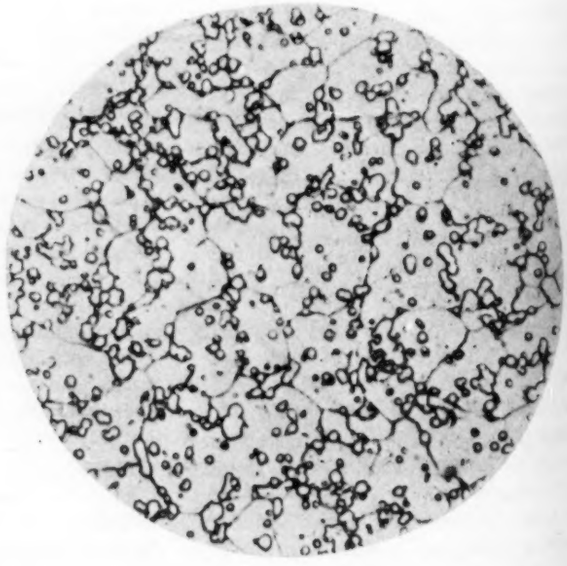
Fig. 5 (left) taken at 1000 diameters, shows the mill annealed structure of a cross-section midway between the outside and middle of a ⅜x1 in. bar from heat S. There are a number of relatively large carbide masses. The cold brittleness may have been partially due to the structural abnormality, although it is more likely that the arsenic and phosphorus tended to embrittle the matrix. The micrographs of material from heat S will be discussed under the heading of "Hardenability," since this heat in addition to exhibiting cold brittleness also showed a low hardenability index.

HARDENABILITY: The hardenability of high speed steel is here considered as an arbitrary index of the capacity

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FIG. 4—(Left) Cross-section of annealed ⅜ x 1 in. high speed steel. Heat E. (Right) As-quenched high speed steel. Heat E. Both etched with 4 per cent Nital, and shown at 1000 diameters.





HIGH SPEED STEEL

By J. G. MORRISON
Metallurgist, Landis Machine Co., Waynesboro, Pa.

of the steel to produce (under the same conditions as regards sample size and heat treatment) a hardness equivalent to that usually found in normal steel, or a higher or lower hardness than normal. Such a test would be whatever the individual might choose to make it; for it is obvious that variations in furnace equipment and furnace atmospheres would so influence heating rates that sample sizes and time-temperature cycles established under one set of conditions—in an electrically heated controlled atmosphere furnace—could not be uniformly duplicated in gas or oil-fired furnaces. On any test for hardenability the analysis of the high speed steel must be taken into account. One would not compare the hardenability of a 0.70 carbon high speed steel with one containing 0.60 carbon. When the tungsten is about 18.5 per cent, the steel tends to react somewhat sluggishly in response to heat treatment as compared to one containing 17.50 per cent. Increasing the vanadium content from 1.00 to 1.25 per cent tends to decrease, but only slightly, the hardness obtained under the set conditions described.

THIS is the conclusion of a two-part article, the first section of which appeared in the April 27 issue. At that time the author described the effect of trace elements, and gave detailed information on sweating. Herein, other heat characteristics are studied, such as cold shortness, hardenability, susceptibility to decarburization, etc.

One of the tests used as a gage of the hardenability of 0.68 to 0.71 carbon material consists of a sample approximating 5/16x1x2 in. There is no particular reason for using this size sample except for the fact that it has been convenient. Samples are prepared so that slightly more than the specified maximum decarburization is removed from each side of the bar. Samples are heated on light heat resisting trays together with control samples. (Samples from one or more heats, the hardenability index of which is known.) Samples are preheated to 1550 deg. F. for a total time of 12 min. in the furnace. One tray is transferred to the high temperature furnace at 2350 deg. F. and is held there for 2 min. 30 sec. and quenched in oil. Another duplicate tray of samples is held in the high temperature side for 3 min 30 sec., or appoximately 1 min. more than would be required in normal hardening. The same controlled temperature furnaces and the same furnace atmospheres are always used for this test.

Normal steel given these two treatments will show "as quenched" a Rockwell C hardness of 65 to 67, pro-

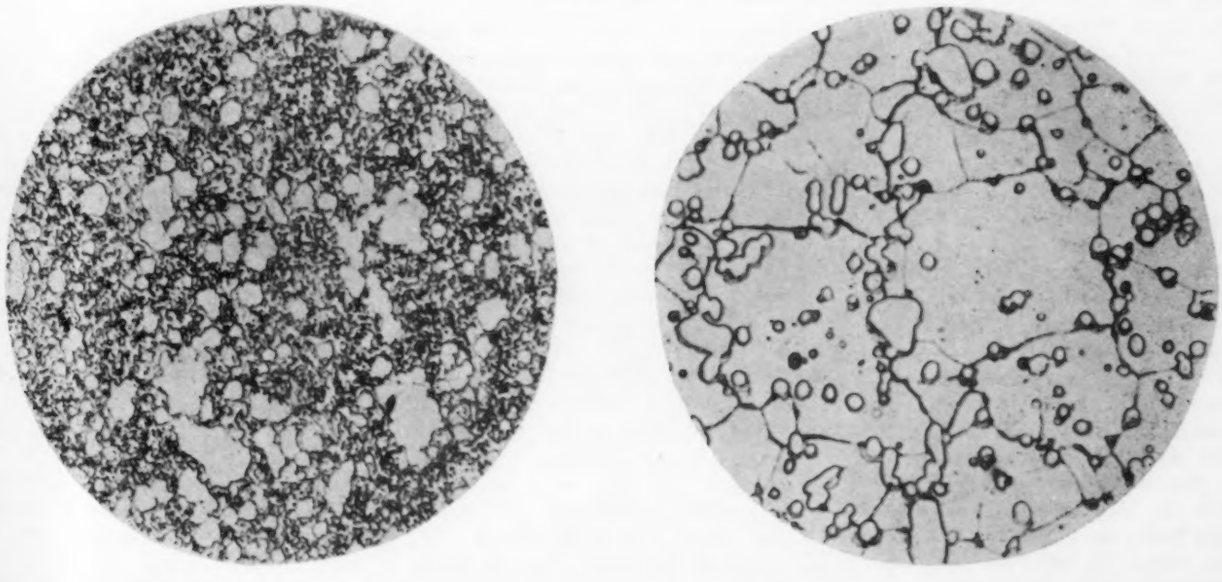


FIG. 5—(Left) Cross-section of annealed 3/8 x 1 in. high speed steel of heat S. (Right) As-quenched high speed steel of heat S. Both etched with 4 per cent Nital and shown at 1000 diameters.

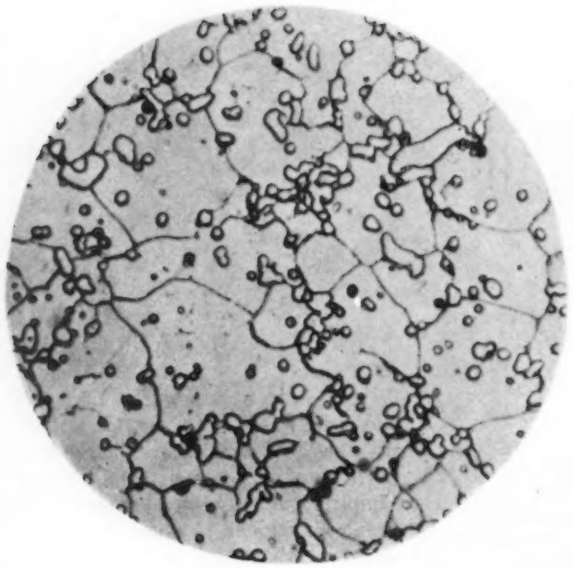


FIG. 6—As-quenched high speed steel of heat F. Etched with 4 per cent Nital and shown at 1000 diameters.

vided the surfaces for Rockwell testing are carefully prepared. If the surface is prepared by grinding, and the surface temperature of the test surface be perchance raised to 700 deg. to 900 deg. F., the hardness test may show as low as 61 Rockwell C. As a general rule, 18-4-1 steel containing 0.70 per cent carbon which shows a true "as quenched" Rockwell C of 66 to 67 will usually show a high degree of red hardness. A steel showing a true "as quenched" hardness of 64 to 65 Rockwell C may or may not show a high degree of red hardness. The "as quenched" hardness of 18-4-1 steel because of the thermal instability of the steel in this state is not considered a very reliable criterion of hardenability. The hardened samples may be nicked in half and examined under the microscope for comparison of austenitic grain sizes when given a usual, or longer than usual, time in the high temperature furnace, and compared with normal steel treated under the same conditions.

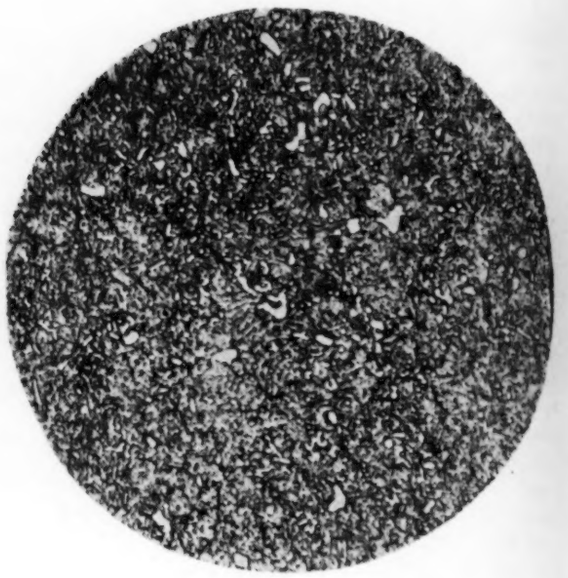
The quenched test samples are drawn at 1050 deg. F. for 2 hr. and then tested. A normal steel will show approximately 64 to 65.5 Rockwell C depending on the time at test temperature. The samples are then redrawn at 1100 deg. F. for 1 hr. Two steels held at 2350 deg. F. for 2 min. 30 sec. may show the same hardness when drawn at 1050 deg. F. When re-drawn at 1100 deg. F. one of the steels may show a lower hardness than the other. Steels in the 0.68 to 0.71 carbon range which show a higher hardenability index than normal are exceptional, and where this condition is found, it is as a rule based on a fractional Rockwell value which is not very conclusive. (In the 0.58 to 0.62 carbon range, or specifically in 0.61 carbon material, a high hardenability index is less exceptional than is the case of the 0.68 to 0.71 carbon range.)

Material made from some heats of 18-4-1 steel exhibit an unmistakably low hardenability index. Table III shows the analyses of three heats of high speed steel which showed low degrees of hardenability. Two heats of steel have been previously listed as heat Z of Table I (in first section of article) and heat S of Table II.

Excessive Aluminum Undesirable

Heats S and Z both showed the same degree of hardenability, producing in the test sample after the 1050 deg. F. draw a Rockwell C of 62 to 62.5, and after the 1100 deg. F. re-draw a Rockwell C of 60.5 to 61.5. Numerous tests were run on sample material from these two heats, and the low hardenability was always prevailing. Both these heats of steel show in addition to other abnormalities of analysis excessive amounts of aluminum. Aluminum in high speed steel has been termed a "bad actor." In excessive amounts it appears to act as a deterrent to the hardening of the steel.

Heat T is an example of a 0.74 carbon high speed steel which contained only a trace of aluminum yet showed a low degree of hardenability. As the carbon of 18-4-1 steel is raised from 0.70 to 0.75 per cent, there is a slight but noticeable change in response to heat treatment. Comparatively, the 0.75 carbon steel is slightly less active in response to heat treatment than is the 0.70 carbon. Consequently, in testing this type of material a slightly longer time is given in the high temperature furnace. Samples of heat T as ordinarily tested should produce a Rockwell C hardness of approximately 64.5 after an 1100 deg. F. draw. However, in the case of this



steel the samples consistently showed a Rockwell C hardness of 61 to 62.

Low hardenability in high speed steel is sometimes attributed to over-annealing, which causes the carbides to agglomerate into relative large masses with subsequent diminution of solution during hardening. The mill records of heat T indicated that this heat was not over-annealed. Microscopic examination of the annealed and treated structures indicated slightly larger carbide size particles than found in normal material. However, the microstructures did not give evidence that the structural difference was sufficiently great to account for the difference in hardenability. While aluminum probably tends to act as an inhibitor affecting hardenability, it would appear likely that other inhibitors may exist.

The micrographs in Fig. 4 to 6 inclusive are a comparison of the annealed and "as quenched" structures of material of heat S and of material from two relatively normal heats of steel.

Fig. 4 shows annealed and hardened structures of heat E. Fig. 5 shows the annealed and hardened structures of heat S of Table III. Fig. 6 is the hardened structure of heat F.

Micrographs shown to the right in Figs. 4 and 5, and in Fig. 6, illustrate the "as quenched" structures of the same size samples from three different heats of steel which were treated at the same time on the same tray at 2350 deg. F. The usual analyses of heats E and F are as follow: Heat E, 0.71 C, 0.21 Mn, 0.015 P, trace of S, 0.029 Si, 4.00 Cr, 17.92 W, 1.01 V, and 0.06 Ni. Heat F, 0.70 C, 0.22 Mn, 0.016 P, trace of S, 0.26 Si, 3.97 Cr, 17.80 W, 0.98 V, and 0.08 Ni.

Fig. 4 (left) shows the structure of a cross-section of a mill-annealed bar ⅜x1 in. taken midway between the outside and center of bar. Fig. 4 (right) is the same sample micrographed in the same relative position after heating to 2350 deg. F. for 3½ min. and then quenching in oil. This steel showed a good response to heat treatment, a considerable resistance to grain growth during heating for hardening, and a hardenability index only slightly lower than average.

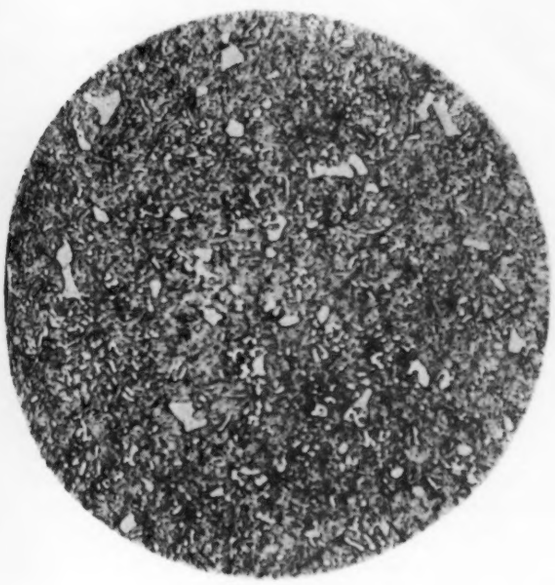
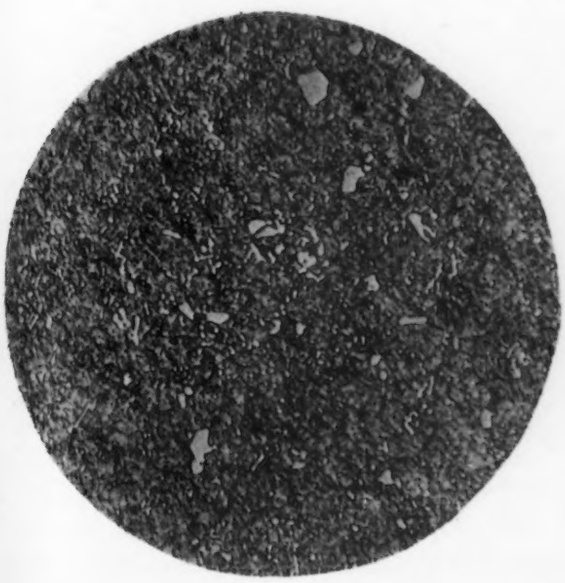


FIG. 7—(Left) "Superior" tool near the cutting edge, as compared with a companion normal tool (right) near the cutting edge. Both etched in 4 per cent Nital and shown at 500 diameters.

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FIG. 8—(Left) "Superior" tool ¼ in. beneath the cutting edge, as compared with a companion normal (right) tool ¼ in. beneath the cutting edge. Etchant is 4 per cent Nital, and micrographs are shown at 500 diameters.



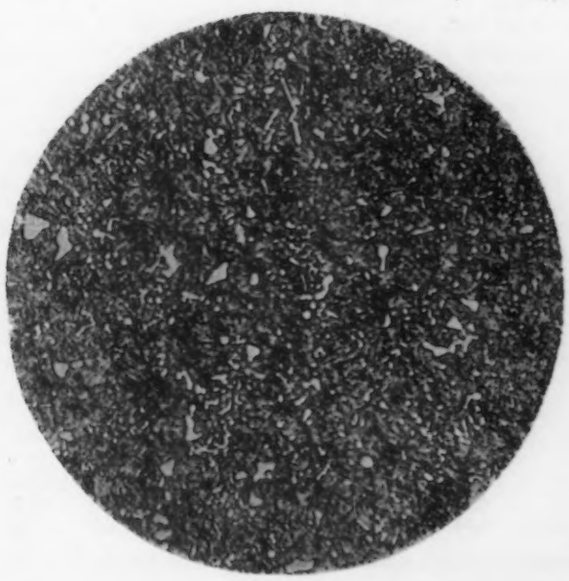


Fig. 5 (left) shows the mill annealed structure of a ⅜x1 in. bar of steel from heat S, taken in the same relative location as that of Fig. 4 (left), of heat E. The micrograph shows abnormally large masses of carbide. Fig. 5 (right) is the "as quenched" structure of a sample of heat S. The grain size of this sample is considerably larger than that of heat E in Fig. 4 (right). The micrograph shows the presence of large carbide masses between the grains and large carbide particles inside the grains. Steel S showed a hardenability index considerably below normal.

Fig. 6 is the "as quenched" structure of heat F. This sample showed a good response to heat treatment, a grain size only somewhat smaller than that of heat S in Fig. 5 (right), although fewer and smaller large carbide masses between the grains, as well as fewer and smaller carbide masses inside the grains.

Susceptibility to Decarburization

The susceptibility of steel made from some heats of 18-4-1 steel to decarburize during heat treatment is well known. Often this tendency to decarburize may be traced to excessive amounts of cobalt, or of cobalt and nickel. Some heats of 18-4-1 steel may be more susceptible to absorbing carbon on the steel surfaces during heat treatment. Susceptibility to decarburization, or to carburization during heat treatment will be discussed in a very general sort of way, since any consideration of these two would require their correlation with furnace equipment, furnace atmospheres and the combination of these two with the

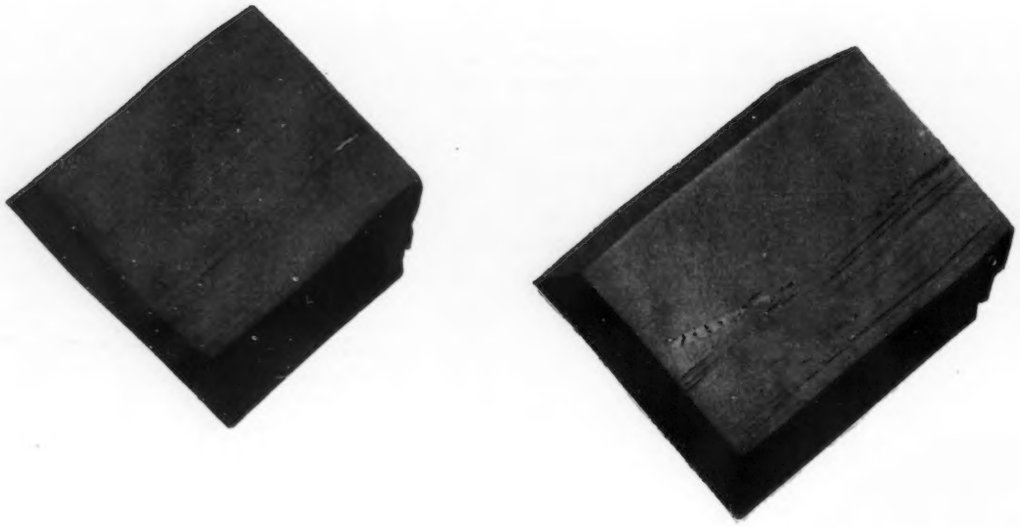


FIG. 9—Hard spots sometimes found near the surface of mill-annealed high speed steel.

shape and mass of the part treated. Furnace atmospheres in connection with the hardening of high speed steel are ever a topic for inconclusive discussion. Controlled atmosphere furnaces have been of tremendous value to the tool manufacturer and great strides are being made, and will continue to be made to improve the properties of the furnace atmospheres.

Much of the present day progress in connection with the development of atmospheres is with the aim of finding an atmosphere which is neutral to the steel surface as regards carbon content of the surface. Furnace atmospheres as used today are actually compromises as related to the steel part or parts being treated. Let it be supposed that it is found that in treating a certain class of tools that a slightly oxidizing atmosphere for preheating at 1550 deg. F. and a strongly reducing atmosphere of about 10 per cent CO in the high heat furnace at 2350 deg. F. produces the most desirable tool, or at least, what opinion and experience indicates to be the best. If a slightly oxidizing condition were correct for preheating the tool at 1550 deg. F., it might be asked what atmosphere should surround the surface of this tool, when, after transferring it to the high heat furnace the surface is passing from 1550 deg. to 1800 deg. F. Obviously if a 2 per cent O_2 atmosphere is correct at 1550 deg. F., a 10 per cent CO atmosphere would not appear correct at the time the surface of the tool was passing through the temperature range of 1550 deg. to 1800 deg. F. Again, at the 2350 deg. F. heat, due to any lack of uniformity of section, some areas or projections of a tool may lose some little surface carbon, while other areas may gain as much as 20 points of carbon for a depth of several thousandths of an inch.

Neutral furnace atmospheres for the heat treatment of high speed steel are frequently spoken of. An atmosphere may be almost ideally neutral to the steel as regards loss of metal. As regards atmospheres being neutral to the surface of the steel in the relation to carbon content of the first few thousandths of an inch, it is very probable that if such an atmosphere were commercially available, the point of neutrality would be of such a hair-line nature that it could not be commercially maintained.

18-4-1 steel is a "glutton" for absorbing carbon on the surface. If one packs high speed steel in carburizing compound and heats it to 2150 deg. F., the surface in time will absorb so much carbon that the edges will melt or fuse due to the lowering of the melting point. If high speed steel is hardened in strongly reducing atmospheres the steel will tend, within reasonable time limits, to absorb some carbon for the first few thousandths of an inch. It is very probable that in controlled atmosphere furnaces, where reducing atmospheres are used in the high temperature side, that more carbon is generally added to the steel surfaces than is taken away. The addition of carbon to the first few thousandths of an inch of a high speed steel surface rather than being objectionable may even be desirable, provided excessive over-heating does not accompany the increased surface carbon. On the other hand, even the loss of some surface carbon, within reasonable limits, may be desirable in some areas of some tools, which because of design are particularly fragile.

Truly an ideal furnace atmosphere condition in relation to the design of certain tools might require the presence of two different atmospheres in the same furnace at the same time—a ridiculous consideration. Perhaps a possible avenue of approach to this matter of furnace atmosphere would

TABLE II

Two Heats of Steel Exhibiting Cold Brittleness

	C	Mn	P	S	Si	Cr	W	V	Ni	Mo	Co	Sn	Sb	Cu	As	Al
Heat R	0.68	0.18	0.012	trace	0.30	4.53	17.40	1.06	0.15	0.07	...	0.025	0.023	0.065	0.024	....
Heat S	0.69	0.29	0.028	0.012	0.21	4.01	17.60	1.08	0.10	0.12	0.12	trace	trace	0.04	0.032	0.047

TABLE III

Three Heats of Steel Showing Low Degrees of Hardenability

	C	Mn	P	S	Si	Cr	W	V	Ni	Mo	Co	Cu	As	Sb	Sn	Al
Heat T	0.74	0.23	0.018	trace	0.39	3.99	17.68	1.01	0.08	...	...	...	....	....	....	trace
Heat Z	0.69	0.25	0.020	0.019	0.30	4.05	18.56	1.01	0.09	0.31	0.54	0.10	0.022	trace	trace	0.052
Heat S	0.69	0.29	0.028	0.012	0.21	4.01	17.60	1.08	0.10	0.12	0.12	0.04	0.032	trace	trace	0.047

be to have an ever changing atmosphere in the high temperature side. After the high speed steel would be transferred to the high temperature side the atmosphere of the furnace which surrounds the steel would change apace so as to be in equilibrium with the changing temperature of the high speed steel surface. However, this would not be so easy to do as it is to put it in print. Again, a heavy-bodied tool with a small projection would have different rates of heating on the same piece.

Decarburization and carburization in the case of hardened high speed steel would appear to be terms having quite definite meanings. Both terms, however, may be used, and are used, to describe the condition of a partial loss, or a partial absorption of the maximum saturation amount of carbon, as opposed respectively to total decarburization or a nearly complete loss of surface carbon; or total carburization when the surface has absorbed the maximum amount or nearly the maximum amount possible under the existing conditions of equilibrium.

If an 0.80 carbon 18-4-1 steel were to be hardened under such conditions that the surface were to lose 15 points of carbon on the first 0.002 in. of surface (or the first 0.002 in. of surface would analyze 0.65 carbon) this surface would very probably be absolutely file hard to a testing file. From a practical standpoint the steel surface is not decarburized; for does it not show absolutely hard to the testing file? From the analytical standpoint the steel has indeed been partially decarburized. It should be observed that little is known in a quantitative way of the hardness of steel surfaces. Up to the present time, no quantitative measurement of the hardness of extremely hard steel surfaces, to so small a depth as 0.0002 in. has been available, which gives a test value, in general, more accurate than that of a good testing file. Quantitative is here used in a restricted or practical sense. For example, suppose a low carbon steel were to be heated in a commercial cyanide-chloride bath for such a time as to obtain a 0.001 in. case, after which it is quenched in water. How could the hardness number of this 0.001 in. case be determined in terms of one of the present day hardness testing systems?

One of the severest handicaps investigators of surface hardness have had to contend with is the lack of a method for evaluating the hardness values of the first one thousandth inch or less of surface thickness in terms of a comprehensible system. That the foregoing should not be understood as only the "voice of one crying in the wilderness," it should be noted that not a single type of hardness testing machine available today gives in a "quantitative" way an adequate estimation of the tremendous surface hardness conferred on the first 0.0005 in. of a nitrided high speed steel surface. *None gives as reliable an index of hardness as the number of inches that may be scratched by a sharp edge nitrided tool on a pane of common window glass.*

The available present day hardness testing equipment is not adequate to permit of an estimate of a hardness number, in comprenhensible terms, of the first 0.0005 in. of surface thickness. What is obtained is the average hardness number of an area of relatively great depth, often a depth so disproportionately great as compared with, say the first 0.0005 in. of surface, as to practically ignore the hardness of this small surface layer.

It might be asked by what means could there be obtained a hardness number value of the first 0.0005 in. of surface thickness on a ground surface where the depth of the grinding scratches might even exceed 0.0005 in. It would seem logical that any test sensitive enough to gage the hardness

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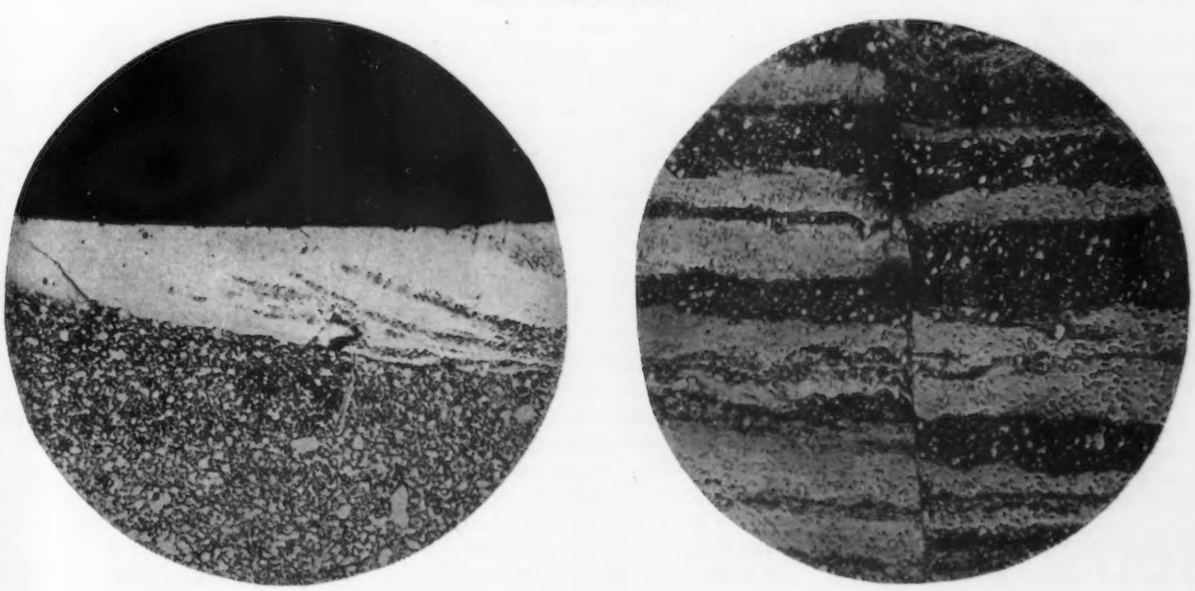
TABLE IV

Analysis of Superior Heat and Several Normal Heats

	C	Mn	P	S	Si	Cr	W	V	Ni
"Superior" heat	0.74	0.18	0.020	trace	0.35	4.04	17.80	0.98	0.078
"Normal" heat A	0.75	0.19	0.018	trace	0.32	4.01	17.84	0.99	0.070
"Normal" heat B	0.74	0.22	0.018	trace	0.31	4.00	17.92	1.00	0.075

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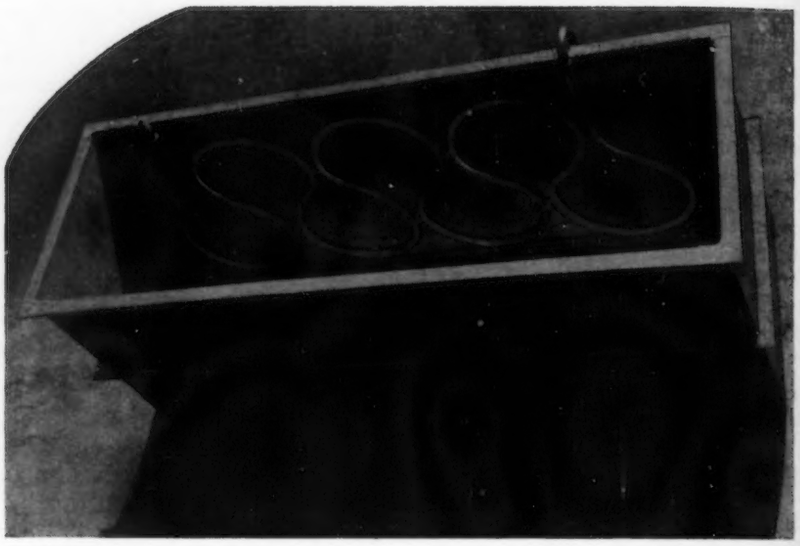
FIG. 10—(Left) Cross-section of hard spot near surface of annealed high speed steel sample shown on right-hand side of Fig. 9. (Right) Surface near one end of hard spot shown in Fig. 9. Etchant 4 per cent Nital. Both shown at 500 diameters.



Lead

By ADOLPH BREGMAN
Consulting Engineer, New York

o o o



PICKLING tank lined with tellurium-lead sheets. Used by a wire mill for acid pickling purposes, this tank has a serpentine heating unit formed from tellurium-lead pipe.

TO the lay public, lead is synonymous with something cheap. To industry, its low cost is one of its great advantages. But even at a higher price the outstanding qualities of lead would make its use imperative in numberless instances. Its great weight (specific gravity 11.3), its resistance to atmospheric corrosion, its resistance to many chemicals, its low melting point (621 deg. F.) and its softness and ease of fabrication all combine to make it distinctive among metals.

The early applications of lead are still important. The Romans used it for plumbing. The Chinese lined their tea chests with it. Bullets for the earliest firearms were made of lead. But these are among the lesser consumers today, although building (including chemical construction), foil and ammunition took over 106,000 tons in 1937. Lead has risen with our modern civilization, its major outlets being storage batteries (with the automobile as the largest single taker) and cable coverings (to prevent corrosion). Other important lead base products are solder, type metal, bearing metal, and calking lead. (The last amounted to the surprising total of 15,000 tons in 1937.)[1]

Lead has also become a modern, high-purity metal, being available 99.99 per cent pure. Although its purity is a valuable addition to its assets, more spectacular improvements recently have been made by the use of small percentages of special metals, such as tellurium and calcium.

In order to understand clearly where lead may or may not be used to advantage, one must bear in mind its peculiar properties. It is a very soft metal. Its tensile strength is low, about 2000 lb. per sq. in. In addition it tends to flow under low loads and should not be subjected to more than 200 lb. per sq. in. continuous pressure. Its fatigue strength is also low. Consequently lead is not a structural metal. Its low strength frequently makes it necessary to strap or bond lead linings, for example to a strong base metal, and to support lead piping to prevent sagging.

Lead's low mechanical strength, however, often is advantageous. It is easy to fabricate, since it is extremely ductile. It is workable, pliable, forgeable and even weldable at room temperature. Consequently it is widely used for calking, and it is extruded around insulated copper cable while cold. Its low melting point and ease of handling, melting, casting, etc., make it the best base for type metals, solders and most fusible metals as well as electric fuses, automatic sprinkler systems, boiler plugs, etc. Its high boiling point (over 2600 deg F.) makes it suitable for the liquid baths in the drawing and tempering of steel. Its great weight serves for ballast. It is also used for sound deadening and for anti-vibration mats in building and machine foundations. It is readily joined, repaired and patched by welding with the oxy-gas torch (lead burning).

Lead has often been called "self-lubricating" the property responsible for its world-wide use in bearings. The same property makes it valuable, even in small percentages, in brasses, bronzes and aluminum alloys for making them free-cutting. Recently lead has been added, to the extent of about 0.2 per cent, in steel screw machine stock for the same purpose, to good effect. Difficulties have arisen in introducing the lead, such as fouling of the molds, but these troubles should be overcome.

A small tonnage use, but interesting, is in scientific and medical work as linings to resist the penetration of short wave length radiations such as X-rays and the Beta and Gamma emanations of radium.

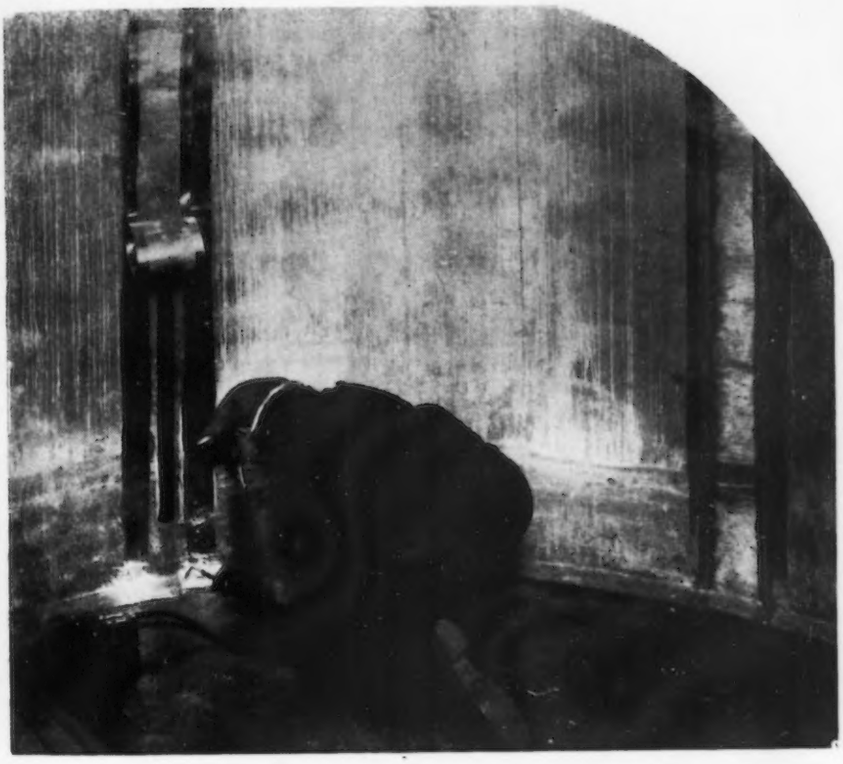
The occurrence in nature of antimony with lead, originally suggested its use as a hardening agent for the lead. It is still the most generally used. The amounts vary from less than 1 per cent in aerial cable coverings to 15 per cent for stiff sheets. Additional hardening and also improvement in fatigue strength can be obtained by heat treatment, but careful manufacturing practice is necessary in producing these antimonial lead alloys because of the fact that they are subject to age hardening and excessive embrittlement if improperly handled.

The outstanding chemical characteristics of lead are its long life under outdoor, underground and marine corrosion, and its resistance to certain acids, sulphuric in particular. Its ability to withstand sulphuric acid and sulphurous compounds makes it a prime necessity for the manufacture of sulphuric acid and in the paper and pulp industry. It is also used to good advantage in sulphonation and chlorination processes, in the organic chemicals industry, and in the manu-

[1] Very large tonnages went into paints which are not considered here as this article is confined to lead as a metal or alloy.

...AN OLD METAL MODERNIZED

FOURTH of a series of articles dealing with "The Right Metal in the Right Place," the objective being to aid manufacturers in selecting the most suitable non-ferrous metal or alloy for their products.



A STEEL bar is placed over the original lead lining of this tank to hold it more firmly in place. To protect the supporting steel, it in turn is also covered with lead by a lead burner, as shown here. Photo courtesy of Lead Industries Association.

facture of explosives and hydrofluoric acid.

In the chemical industry, in most instances, "chemical" lead is used (99.92 per cent pure). Where greater strength and rigidity are required, hard lead (from 3 to 8 per cent antimony) is called for. In chromium plating, for the insoluble anodes and for the tank linings, antimonial lead, about 6 per cent Sb, is practically standard.

Lead's "permanence" accounts for its use in cable sheathing, plumbing, roofing, leaders, gutters, service pipe, drains, "weathercaps" for protecting masonry joints, etc. Its impermeability to moisture makes it useful for lining shower rooms, for waterproofing applications and for conveying liquids. Its resistance to salt water and also salt water spray places it in the van for pipe, pumps and valves on board ship and for submarine cable covering.

As stated above, the steps forward recently taken by lead have been in the direction of the use of small quantities of special additions. Tellurium lead (Te 0.04 to 0.10, balance Pb) exhibits much more strength and resistance to fatigue and to corrosion than pure lead or antimonial lead. It is work hardenable, its tensile strength being raised to 5000 lb. per sq. in. A valuable application of this property has been found in the fact that pipes made of tellurium lead can be frozen a number of times without bursting due to its resistance to stress, and the distribution of deformation. The advent of this alloy has done much to increase the use of lead in the chemical industry.

The addition of 0.04 calcium has produced an age-hardening alloy with striking possibilities. After rapid cooling from about 575 deg., its tensile strength will increase until it is doubled or tripled and its fatigue strength is three to five times that of pure lead. Calcium, magnesium and tin added to lead give an alloy with a tensile strength of 4000 to 6000 lb. per sq. in., fatigue strength of 1400 to 2000 lb. per sq. in., creep strength of 750 lb. per sq. in., with a creep of 1 per cent in a year.

The practical economic importance of the low cost of lead was thrown into sharp relief by the automobile industry which recently took a significant step in returning to lead for bearings. Under the pressure of the need for reducing costs to the very last penny, cars are now using more of the SAE 14 (75 lead, 15 antimony, 10 tin) bearings. This gives adequate service at a very much lower cost than many of the special and more expensive bearings available.

Lead's high reclamation value is an additional economic advantage. It is estimated that 75 per cent of the lead in worn out batteries returns to industry as secondary lead for re-use.

Lead is preeminently suitable for use, therefore, where the following properties are desired:

(1) Resistance to sulphuric acid and sulphurous compounds.

(2) Resistance to atmospheric, underground and salt water corrosion.

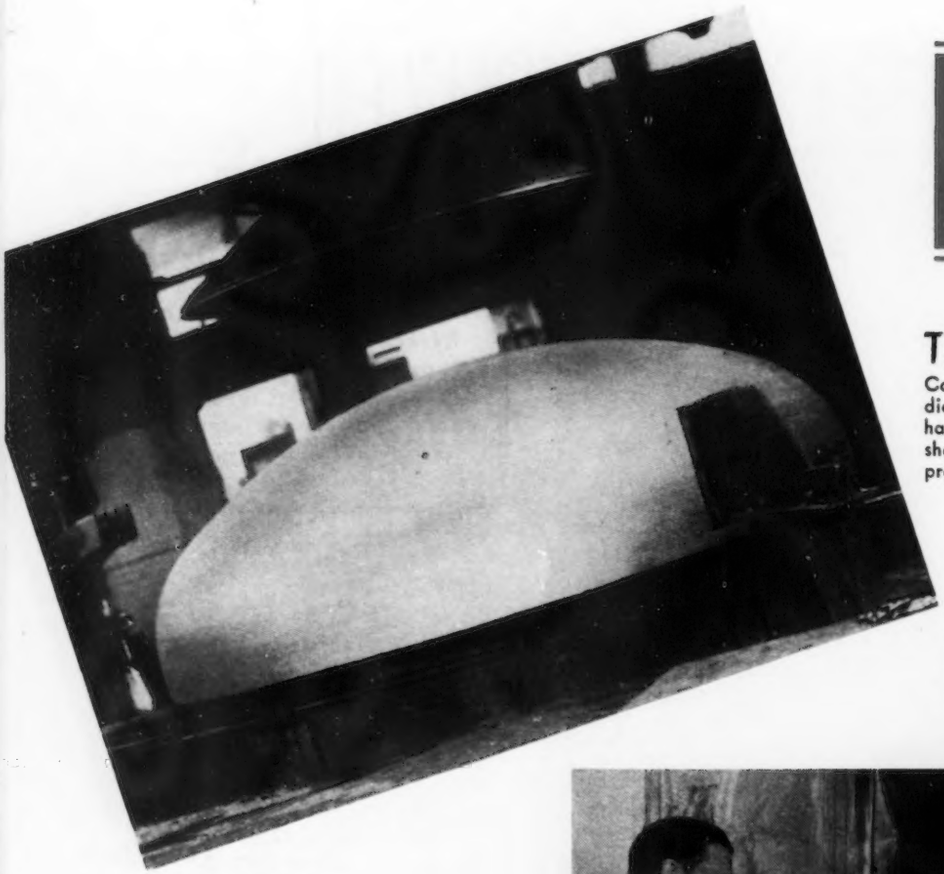
(3) Excellent anti-friction properties.

(4) Softness and extreme workability.

(5) Low melting point (combined with high boiling point).

(6) Low cost and high reclamation value.

What's

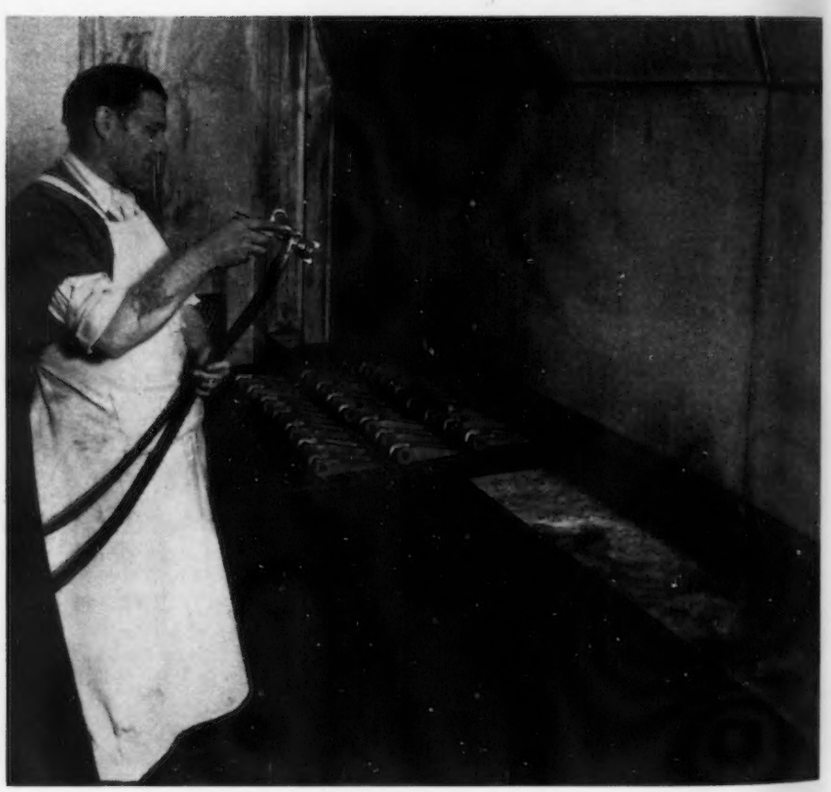


AT LEFT

THIS elliptical head, one of the world's largest, was formed recently by Lukens Steel Co. for A. O. Smith Corp. It weighs 23,460 lb., measures 13 ft. inside diameter, with an inside overall depth of 41½ in., and has a 2⅛ in. minimum thickness. The finished head is shown here with edges turned down, central portion pressed to elliptical shape, and edges flanged, before removal from the spinning machine.

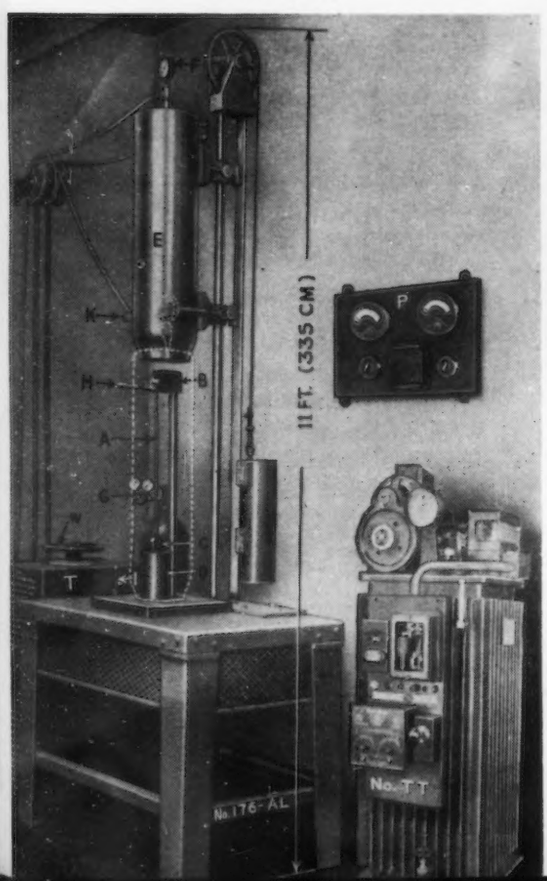
BELOW

A MODERN spray booth at the International Business Machines Corp. plant at Endicott, N. Y. Paint is stored, mixed and fed from a central point. Each booth is ventilated by warm air in winter and cold air in summer, and the back of the booth is a continuous curtain of falling water (130 ft. per min.) which contains a chemical compound to absorb paint.



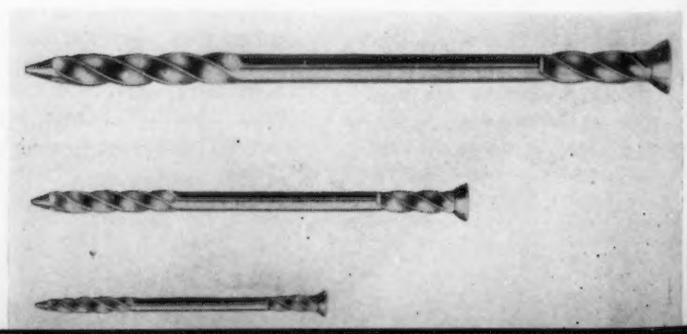
BELOW

AFTER tungsten powder is compressed and sintered into slugs and rods from 6 to 30 in. long, either round or square, the Eisler Engineering Co., Inc., Newark, N. J., heat treats by passing an electric current through the material. The current is 2140 amp. at 8 to 18 volts, and the slug (A) is held at the top by a stationary jaw and at the bottom by a jaw (C) that floats in a mercury cup (D) to allow for shrinkage. Bottle (E) and mercury cup are water cooled.



BELOW

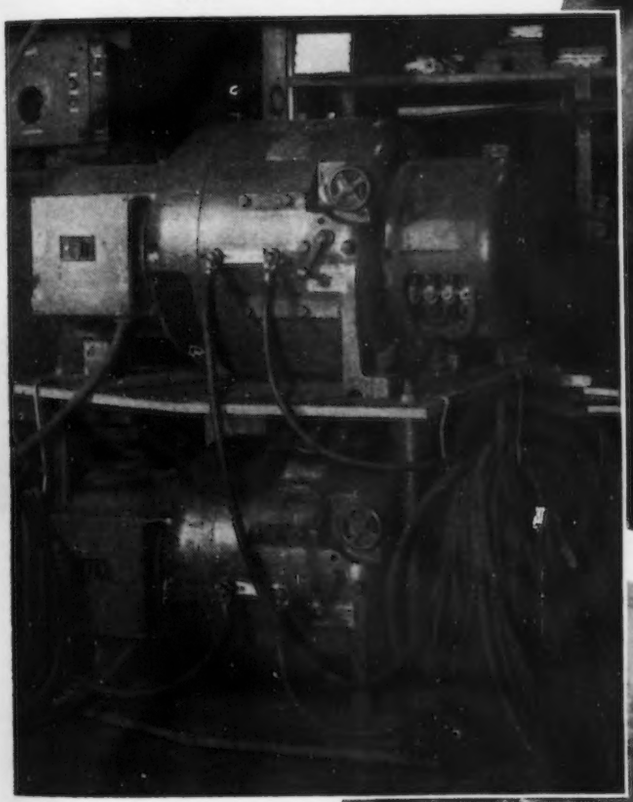
DOUBLE grip spikes with a spiral neck and foot have been developed recently by the Pittsburgh Screw & Bolt Corp. for permanent fastening of wooden structures. The upper spiral is synchronized with the lower so that the rupture of the wood fibres is kept at a minimum, at the same time giving the spike increased gripping power.



New!

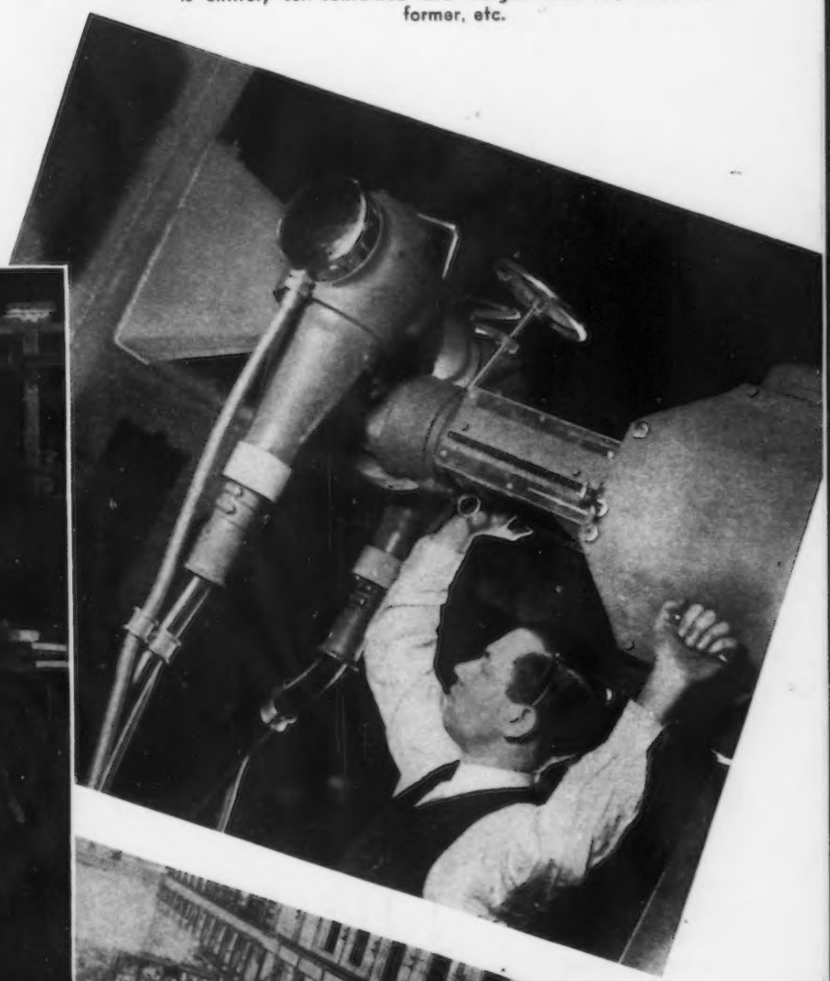
BELOW

BECAUSE of limited floor space, the convenience of single-operator welding sets is often restricted. Mounting of one set above another, as shown here, reduces floor space requirements and aids in maintaining an orderly welding section. The stand is made from 1-in. steel plate and 3-in. pipe. Photo by Westinghouse.



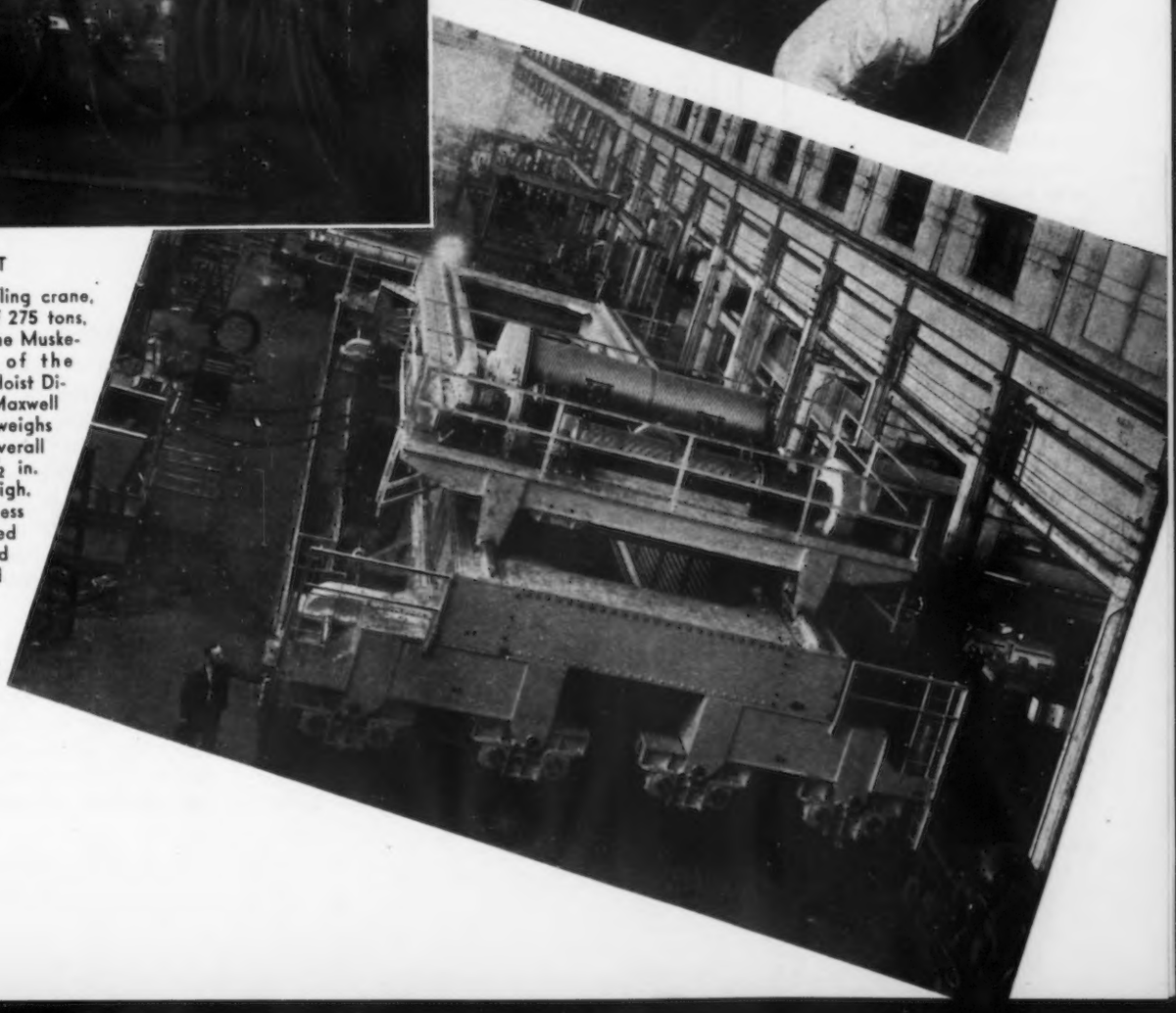
BELOW

NEW 220,000-volt portable X-ray machine developed by Westinghouse for examining welds in steel plate or castings up to 3 in. thick. The focusing mechanism is extremely flexible so that the instrument can be aimed at a weld or casting in any position from horizontal to vertical, as demonstrated by the focusing on a steel transformer tank. The unit is entirely self-contained and weighs 4500 lb., with transformer, etc.



AT RIGHT

THIS electric traveling crane, with a capacity of 275 tons, is being erected in the Muskegon, Mich., shops of the Shaw-Box Crane & Hoist Division of Manning, Maxwell & Moore. The crane weighs 242 tons, has an overall length of 72 ft. 7½ in. and is 17 ft. ¾ in. high. The ShaWeld process of welding was used for fabrication, and even the gears and sheaves are welded. Wheels are mounted in pairs in equalizing trucks in order to distribute the load on the crane rail.





SHORT CYCLE ANNEALING

By W. F. ROSS

Electric Furnace Co., Salem, Ohio

INITIATED by a few of the larger producers of malleable castings for the automotive and machine production industry, the trend toward furnace equipment designed to decrease annealing time to a minimum has steadily asserted itself. At the present time malleableizing cycles of over 55 hr. are becoming rare and increasingly costly in relation to the newer methods of production in this highly competitive field. The amount of interest displayed in present-day malleableizing equipment by foundry executives shows conclusively that even the smaller producers are contemplating the possibility of short cycle annealing.

An analysis of foundry methods in malleableizing illustrates the logical development of a treating cycle adapted to the production of castings with satisfactory physical properties but with a vastly decreased time requirement for the entire heat treating process.

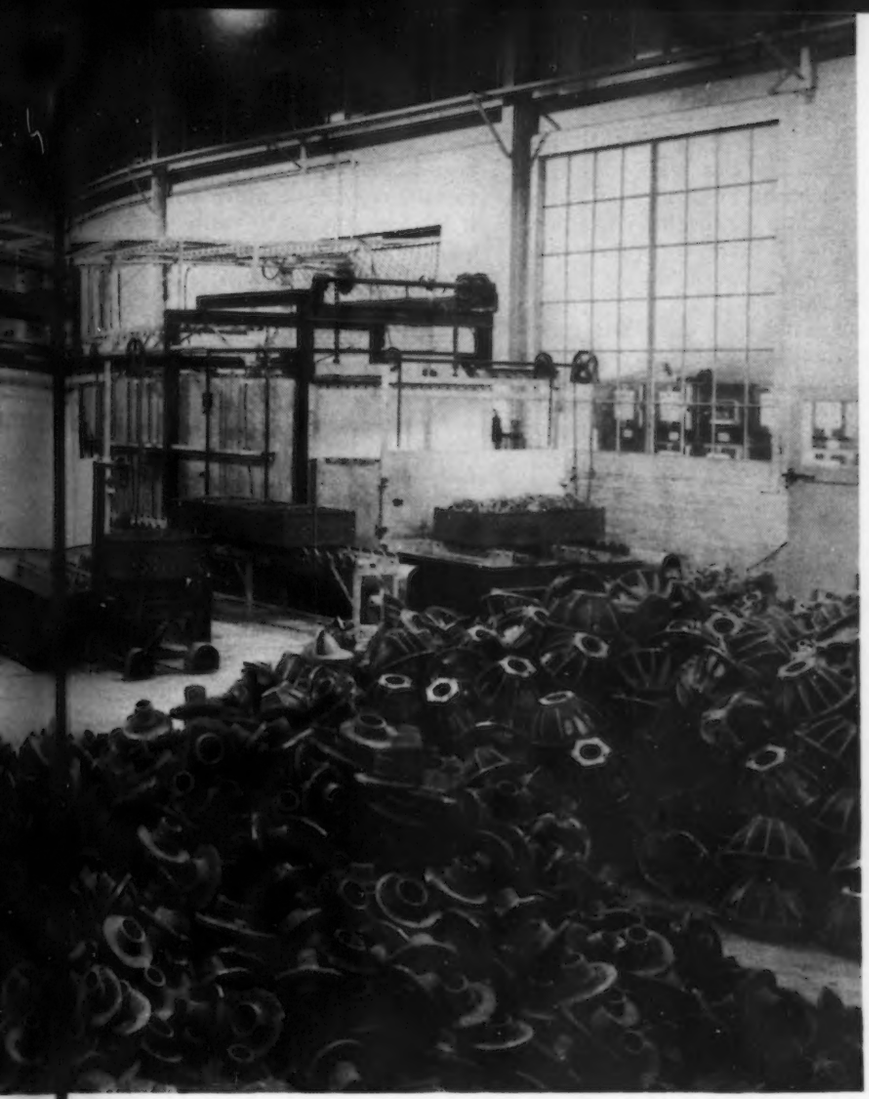
Based on production methods of a decade ago, charges, packed in scale or ore filled pots and covered, were placed on stools in box type kilns and heated to from 1550 deg. to 1650 deg. F. in approximately 30 to 40 hr. This heating-up period was followed by a soaking period of from 50 to 65 hr., after which cooling to about 1200 deg. F. for a period of 80 to 90 hr. in the kiln permitted the opening of the kiln for relatively fast cooling to 500 deg. or 600 deg. F. prior to removing and unpacking the charges. The total cycle was, therefore, from 175 to 225 hr., assuming 5 to 10 hr. total handling time.

The castings produced by this cycle were uniformly satisfactory in regard to machining qualities, elongation (18 to 20 per cent), and tensile strength (50,000 lb. per sq.in. or better). The retention of these characteristics, together with the beneficial advantages of a relatively short malleableizing cycle, constitutes a metallurgical problem which may briefly be analyzed.

Short Cycle Analyzed

The speed of graphitization during the heating-up and soaking periods is in direct relation to the temperature employed. Therefore, the cycle may be materially shortened during this phase of the annealing cycle by employing temperatures somewhat higher than the 1550 deg F. referred to above. At the higher temperature, however, excessive grain growth or over-annealing must be prevented by dropping the temperature of the charge rapidly to a semi-critical temperature, or about 1400 deg. F., a condition manifestly impossible to effect in the kiln or batch type annealing equipment unless the entire charge is withdrawn from the heating chamber.

From 1400 deg. F., precipitation of temper carbon is continued by cooling slowly to about 1300 deg. F. before withdrawing the material from the heat. The various steps, including the fast and slow cooling, would indicate the practical utilization of a furnace



CHARGING end of two identical 340 kw. pusher type, roller rail conveyor malleableizing furnaces. Conveyors return empty containers from discharge to charging end. The Elfurno atmosphere generator is located above and between the furnaces to save floor space.

of MALLEABLE IRON...

equipment of the continuous type for malleableizing.

Although much effort and thought has been placed on the experimental design of practical equipment of the semi-batch type, suitable for foundries whose production requirements are either spasmodic or small, the greatest recent malleableizing developments have been in continuous furnace equipment.

The elements necessary to design a continuous malleableizing furnace, with suitable provision for all factors influencing the actual time interval, resolve into an equipment broadly described as a continuous conveyor type equipment, suitably divided into separately controlled heating, fast cooling and slow cooling zones, designed with provision for controlled atmosphere to eliminate the scaling of castings by oxidation, thus materially reducing the tare weight of supports, containers and packing.

The application of special atmosphere to malleableizing constitutes a major factor in the development of short cycle work. A continuous furnace adapted to the now obsolete malleableizing cycles and arranged to anneal work packed in pots would not only reach inconceivable proportions, but would certainly be grossly inefficient and costly.

The elimination of all tare weight except for relatively light conveying trays or boxes may therefore be attributed to the utilization of non-oxidizing atmosphere, which surrounds the work while subjected to all temperatures within the oxidizing range and thus prevents the formation of scale.

Any furnace equipment to be used in conjunction with a special protective atmosphere must be arranged for effective sealing by means of welded joints in the enclosing shell, and charging and discharge opening of the lock chamber, vestibule, or similar type.

Of the numerous cycles employed in present-day malleableizing with continuous equipment, those requiring from 30 to 50 hr. are best illustrative of modern continuous equipment. Other cycles ranging as low as 12½ hr. are used extensively with special analysis malleable castings, but the sequence of temperature steps in all these cycles is substantially similar.

The most interesting specially developed malleableizing furnaces of the continuous type have made use of the *continuous pusher* or of the *roller hearth* conveyor systems, either of which is adaptable to heating by means of electric power or fuel fired radiant tubes.

Designed for a production of 833 lb. per hr., the 340-kw. pusher type annealing equipment of a large Canadian plant consists of a hydraulic pusher operated roller rail conveyor extending the length of the furnace and cooling chambers, which is arranged in each equipment to accommodate two rows of material loaded

in box type trays of heat-resisting alloy construction.

Based on simultaneously charging two loaded trays per furnace, weighing approximately 211 lb. per tray and each loaded with an average of 440 lb. of castings, the above rate of production is accomplished with a total time cycle of approximately 36 hr. in the furnace. The material is quickly heated to 1500 deg. F., then slowly heated to 1700 deg. F. and allowed to soak 10 or more hours. The metal is then quickly cooled to 1400 deg., slowly cooled to 1300 deg. and discharged. The time interval between charges amounts to approximately 63¼ min.

In operation, two loaded trays are placed on a charging extension adjacent to a close fitting plate type door, which seals a charging vestibule. The operator opens this door, moves the trays forward into the charging vestibule adjacent to the charging door of the furnace chamber proper, and recloses the outer or vestibule door. The door at the discharge end of the furnace equipment is then opened and two finished trays of material withdrawn from the discharge vestibule on to an unloading extension.

At the proper time the inner or chamber door at the charging end of the equipment opens, and the hydraulic pusher moves the two loaded trays previously placed in the charging vestibule forward into the heating chamber, where the trays become part of the continuous lines extending through the equipment. Each line is moved one tray length forward with succeeding pushes. When the forward push is complete, the pusher retracts, the charging door closes and the operator prepares for a succeeding charge, as just described.

After introduction to the furnace chamber, the material moves at intervals through the long heating chamber and through the fast cooling section, where heat is rapidly withdrawn from the work by means of air ducts passing over and under the work.

The last phase of the cycle occurs in the slow cooling section, where the required cooling rate is maintained by automatic temperature control in conjunction with heating elements arranged to retard too fast cooling due to radiation from the chamber shell.

As trays of finished material are withdrawn to the discharge extension, each tray is dumped and returned to the charging end of the equipment upon a gravity conveyor.

Heat to the work is supplied by means of heavy cast alloy grid type heating elements, suspended from the furnace arch in the heating-up section, and resting beneath the roller rails in the heating-up, soaking and slow cooling sections. In all, five separate and automatically controlled zones provide the heating steps necessary in the malleableizing cycle. One similarly controlled zone is placed between the soaking and slow cooling zones, arranged to accelerate or retard the fast cooling rate.

Although the equipment is arranged for electric heating, radiant tubes of the fuel fired type may be easily substituted for the grid type heating elements described if they are more economical.

Roller Hearth Type

The general operation of the roller hearth malleableizing equipment differs from that of the roller rail pusher type equipment in that the material moves through the furnace chamber continuously at uniform speed.

Since trays of material being conveyed through the furnace equipment are not dependent for movement upon the preceding or succeeding tray, much lighter tray construction may be utilized than would be possible in a pusher type furnace. There is thus an obvious advantage of a reduction in tare weight.

By equipping each roll with suitable gas-tight seals at the points where the roll passes through the furnace walls and shell, the roller hearth equipment is made adaptable to the use of controlled atmosphere for the prevention of scaling or oxidation upon the work.

A continuous roller hearth conveyor type malleableizing furnace equipment installed in the plant of a producer of castings for the automotive trade makes use of a special short cycle for the annealing of castings of somewhat different analysis than that used in regular malleable iron works. The major metallurgical difference lies in a reduction of the carbon content and an increase in the content of silicon, the proportional amounts depending upon the physical requirements of the short cycle castings. It is claimed that such short cycle castings show a slightly higher elongation (12 to 18 per cent), with corresponding tensile strengths up to 62,000 lb. per sq. in.

The heating and cooling time for short cycle annealing in this particular installation is less than 13 hr. The material is quickly heated from cold to 1750 deg. F., allowed to soak approximately 3 hr., cooled quickly to 1450 deg. F. and then slowly cooled down to 1100 deg. F. at which temperature it is discharged—the entire cycle requiring only 12 hr., 36 min.

The relatively short time cycle affords a much greater hourly production from an equipment of the same size as specified in the preceding paragraphs, because of the accelerated rate at which the material passes over the hearth and because of the elimination of some tare weight in the conveying trays, which affords a better gross to tare ratio.

The 860-kw. equipment consists of an electrically heated heating and soaking chamber, approximately 49 ft. long, adjacent to which is placed a rapid cooling section equipped with water cooled ducts. Successive cooling chambers, equipped with electric heating elements to retard the rate of cooling, and an end cooling chamber for final cooling complete the chamber portion of the furnace proper.

Gas-tight lock chambers at both ends of the equipment afford means of charging and discharging loaded trays of material with minimized loss of special atmosphere from the furnace chambers, and prevent air infiltration to the chambers.

Special atmosphere, with which the furnace chambers, the cooling chambers and the lock chambers at each end are continuously filled, is produced by a generator equipment utilizing the available combustible gas from the purchaser's line, which, when properly mixed with metered amounts of air and burned in a combustion chamber, afford products of combustion of an analysis suitable for the prevention of oxidation on work passing through the equipment. Before introduction to the furnace chambers, provision is made for the reduction of moisture in the products of combustion by means of cooling the gas in a surface type cooler.

The equipment is designed to accommodate suitable conveying trays of heat-resistant cast nickel-chromium alloy construction, measuring approximately 27 in. square and weighing approximately 100 lb. per tray. Two trays, each loaded with approximately 350 lb. of material, are loaded and charged simultaneously at intervals of 16½ min. Based on a conservative loading of 350 lb. per tray, the equipment was designed to produce approximately 2500 lb. of material per hr., utilizing the annealing cycle described. However, the actual equipment under test conditions has produced as high as 2900 lb. of material per hr.

Open-Hearth Problems Probed

By T. W. LIPPERT

Metallurgical Editor, The Iron Age

° ° °

ALMOST pleased gleam was in the eyes of L. F. Reinartz, of Armco, last week in Cleveland. As well they might gleam; for he could remember the handful of men gathered many years ago in Pittsburgh for the first meeting of the Open Hearth Committee of the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

Last week's three-day meeting in Cleveland marked the 22nd assembly of the Committee—registration established a new record, being over 500, there being included representatives of practically every steel plant in the United States, over 80 open hearth superintendents and assistants, and over 50 metallurgists. These men were gathered in what has become the most unique technical conference in the country—the annual horse trading session of the men who melt and refine steel—the annual attempt to both help the other fellow with his problems and in return secure at least partial solutions to problems bedeviling every melting shop. As in the past few years, the Blast Furnace and Raw Materials Committee met in simultaneous sessions with the open hearth group, the two groups also participating in one joint session. The blast furnace men were in Cleveland for exactly the same reason—to give a little information and to secure a little information.

Only one factor marred what was otherwise the most successful of all the open hearth meetings. That was the sickness and absence of F. B. McKune, of Steel Co. of Canada, Ltd. For years Mr. McKune's participation in discussions and acrid observations have been enjoyed and looked forward to by those regularly attending the meetings.

The first technical session of the open hearth group, Wednesday morning, April 26, was confined entirely to industrial relations, a subject which seldom has been discussed in past meetings.

The first speaker was Russell Chaffin, director of industrial relations, Continental Steel Corp., Kokomo. Mr. Chaffin quickly pointed out that the major problem was not merely one of handling grievances, but was somewhat broader, that is an "investigation, control and disposition of alleged injustices."

It was shown there would always exist in every plant a certain number of grievances, as no one ever expects to reach that stage of personal perfection in which all decisions and actions will be accepted by everyone as fair and just. For this reason, a certain number of complaints must be expected and they must be properly handled. Any employee who states a grievance has the right to expect one of two things: either an assurance that the undesirable conditions will be remedied, or a thorough explanation of why his complaint has no merit and cannot be acted upon. An abrupt "yes," according to Mr. Chaffin, is not satisfactory; and an abrupt "no" is doubly unsatisfactory. A proper explanation is advisable in any case.

A workman or committeeman may be pleased by a simple agreement to grant a request; but if it is agreed to in a hasty manner, he may be prompted to remember how long the condition existed before it was corrected. He may fail to appreciate what you do if he blames you for not having done it sooner. Proper explanation frequently will replace ill will with good will. Mr. Chaffin was particularly emphatic in pointing out the advisability of remembering that a proper explanation, however, does not consist of an evasive "salve," but of facts which admit fault when it should be admitted, and which explain delays which are unavoidable. If a negative answer must be given, it is even more important to explain fully the reasons.

As to the broad policy suggested for handling grievances, Mr. Chaffin emphasized the following:

(1) Do everything possible to find and correct objectionable conditions before they are brought to the attention of management by collective bargaining machinery.

(2) Take steps to provide all supervisory agents with proper information regarding company policy and with proper training in methods of

discussing complaints with employees.

(3) Be certain that answers are not given hastily.

(4) Impress supervisors with the importance of properly settling all complaints at their source, if possible.

(5) Have supervisors, high or low, delay all positive answers for at least a few hours, so that a check can be made on original convictions and, most important, decide on the type of explanation and reasoning which will be most satisfactorily accepted.

(6) Make definite practice of avoiding unnecessary delay in either correcting a condition or in presenting satisfactory explanation of reasons for delay or refusal.

(7) Reduce to writing as completely as possible all reports and agreements which must be depended upon in future dealings.

(8) Inasmuch as a final decision often eventually goes through the hands of an impartial umpire, an attempt should be made at all times to view the complete facts in each complaint in as fair a manner as is possible and give a decision such as an impartial umpire might be expected to give.



FIG. 1—Fourteen years of improvement in the safe cleaning of ingot molds at the Armco plant. In 1924 the ingot yard was as shown above—there were many serious accidents. A few years ago the arrangement at right was devised, which made the work far safer. Lately, the enclosed, motor operated cab at lower right was installed, which incorporates all the safety features practicable.

Safety In Open Hearth

Following Mr. Chaffin's talk, considerable discussion appeared on the problem of grievances, the bulk of which emphasized the need of stopping as many grievances as near the source as is possible, the importance of adequate machinery for handling grievances and the danger of permitting grievances to bounce over or bypass foremen or superintendents, and the advisability of taking adequate time before a final yes or no is given.

The next subject brought up for discussion was that dealing with safety in the open hearth, a problem which developed a great deal of interest. C. R. FonDersmith, of Armco, had considerable to offer, and first pointed out that by the constant application of safe practices there has resulted a steady down-trend in both severity and frequency of accidents in the open hearth. It was shown by Mr. FonDersmith that according to the National Safety Council figures for 1937, the accident frequency for open hearth workers was 11.68 with a severity of 3.99; as compared with the entire steel industry, which had an accident frequency of 8.51 and a severity of 2.07. The accident frequency for open hearths was only exceeded by the rod, skelp and strip mills and the severity of open hearth accidents was only exceeded by the severity of accidents in the bessemer department. The types of hazards prevalent in the open hearth are such that great care must be exercised to prevent injury. But, according to Mr. FonDersmith, the wage rates of this part of the mill are such that it is possible to select and choose men of higher average intelligence so that they should be more alert to the presence of those hazards.

It was also pointed out how Armco attempts to establish certain standard safety precautions developed through cooperation with the men themselves, and then selling all the men on observing these practices and in some instances forcibly making them adhere to the rules.

Mr. FonDersmith also mentioned certain specific instances of Armco's approach to safety problems in the open hearth, as for instance:

(1) Prior to 1924 they were troubled with numerous burns due to oxygen explosions. In cooperation with the manufacturer, a master regulator for a three-bottle manifold was developed and assembled on a portable buggy. This stopped the burns and explosions, but still the hazard of handling bottles was present; so in 1937 a Driox system was installed with leads to all parts of the floor where oxygen is used. This has completely eliminated the hazard.

(2) Many burns resulted on the pouring platform from the teeming operation, prior to 1927. When, in cooperation with the manufacturer, a safety apron and leggings were designed and put into use, this stopped the potential accidents at this source.

(3) After a fatal accident in back of the furnace in 1924, a movable hinged guard rail was developed to prevent the helper from falling into the pit when working the taphole after the runner was removed and after the heat was tapped. Armco has had no injuries from this source since that time.

(4) The mold yard in former years was a constant potential source of very serious injuries resulting in a loss of life or limbs. A constant development of this operation has resulted in a much reduced hazard. These developments consisted in better physical layout, improved mold handling mechanisms and traveling platforms. The three pictures (see

Fig. 1) tell their own story, extending over the 14 years from 1924 to 1938.

(5) Stockyard men used to think it was "sissy" to wear protective clothing, and thus were exposed to many puncture wounds with the danger of infections and bruises from flying pieces of scrap. These men are now clothed completely in protective clothing. The one place that has as yet baffled Armco's efforts has been that part of the foot back of the safety toe on the shoe to where the legging starts. There have been several broken bones in this section of the foot, and no satisfactory method has as yet been developed to protect this part from falling pieces of scrap. Another potential source of danger in the stockyard is from link and pin buggy equipment. Several experimental automatic coupler installations have been made to find their defects, and now Armco is proceeding to equip all rolling stock in this manner.

As a result of all this adherence to safety devices and the selling of men on safety, Armco has had two out of three open hearth shops come through the year 1938 without a major accident.

The question next came up as to the use of safety masks. Mr. FonDersmith said that Armco has experimented with several types and is now experimentally using one made by Mine Safety Appliance Co. This is a wire screen mask and is used by workers tapping furnaces. So far, it seems to be the most satisfactory, as opposed to certain types of masks which tend to smother the men, that is those types having little provision for ventilation.

As regards the discussion on the use of woolen protective clothing for open hearth workers, it was evident that few plants so protect men working in front of the furnace. However, the representative from J. & L. said that all their workers were so protected, and several other plants mentioned that they were considering making adoption of such clothing compulsory for all workers. Some discussion arose as to the reluctance of men to wear such clothing in the summer, due to the heat, but the Wooster plant of the American Steel & Wire Co. said that its workers had little complaint regarding the wearing of such clothing in the summer. Several mills mentioned a preference for impregnated duck clothing, it being lighter and considerably more resistant to fire, although it was admitted that on washing a considerable amount of the impregnation sometimes comes out. It was also said that occasionally workers who wore such impregnated clothing complained of a skin rash, but this was countered with an observation that workers using their regular clothing often suffered from such rashes when their clothing was not washed when necessary. The inference was that dirt rather than impregnation often resulted in such rashes.



Although most of the discussion of open hearth safety concerned itself with the avoidance of burns, there was some information brought out regarding other types of injuries. For instance, it was evident that most open hearth superintendents are not satisfied with the types of glasses now available. In fact, the Committee is gathering data on suggestions for improvement of goggles and will transmit these suggestions to several of the goggle makers.

J. & L. pointed out that because of a recent severe eye injury due to a hot particle coming in through the side, all workers are now required to wear goggles having side shields. This same company also insists that all



workers on the open hearth floor wear shoes having standard safety features, a practice which is not yet prevalent among other plants.

Many goggles are not thick enough, and the lenses do not filter out ultraviolet light, and often the lenses are far too small for complete protection. One superintendent stated that his company uses a blue and white combination goggle made by American Optical Co. which they consider satisfactory, and another company expressed some satisfaction with a goggle having a lens of two shades of amber. It is evident, however, that there is not complete accord regarding the efficiency of goggles, and it was also evident from the remarks that side shields would probably become far more popular in the next few years.

Refractories Discussed

At 12:15 the open hearth group adjourned and met with the blast furnace men for a joint luncheon. D. B. Gillies, of Republic, and president of the A.I.M.E., welcomed the groups and also introduced a representative of the mayor of Cleveland who expressed the city's welcome.

In the afternoon session of the open hearth committee, refractories was the sole subject of discussion. Undoubtedly the most interesting of the discussions centered in the type of furnace bottom recently put in by the Pittsburgh Steel Co. The general trend of furnace bottom construction as well as a review of this particular bottom was presented by Alex M. Morton, of the Pittsburgh Steel Co., Monessen, Pa.

Mr. Morton pointed out that since the advent of basic open hearth furnaces in steel making, the method of installing furnace bottoms changed very little up until the World War period, when the supply of Austrian magnesite was limited. Prior to the war, some dolomite and lime was used, but generally speaking, the conventional bottom was installed with Austrian magnesite, using basic open hearth slag as a bond.

Solid concrete piers were used as a foundation in the early period, topped with several courses of a red brick, up to a point where clay brick was used. The rough contour of the hearth was shaped with clay brick, faced with magnesite brick, allowing from 12 in. to 27 in. of grain magnesite, which was burned in. As pan bottoms were installed, the thickness of refractory materials has been cut down to a minimum, but there are still a number of solid bottoms in existence, and many bottoms that are 25 years old, or more.

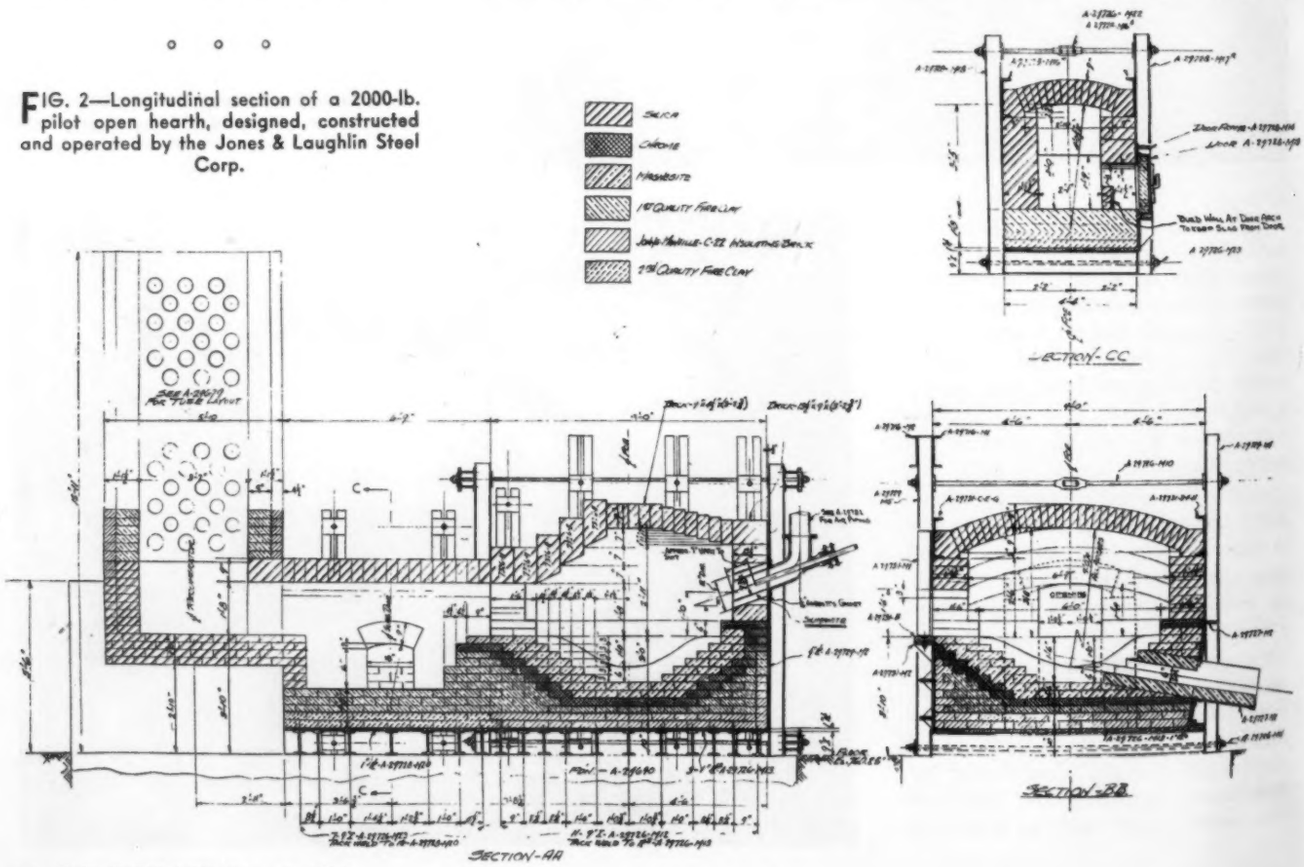
During the shortage of magnesite brick, several plants, according to Mr. Morton, used chrome brick as a substitute in bottoms. Time proved that chrome brick did not disintegrate as did the magnesite brick, and from the year 1920 until the present time, chrome brick has been used in most installations, leaving many large sized expansion joints throughout the hearth. However, in later years no expansion has been left where chrome brick is used.

After describing the conventional use of slag wash and the burning in of grain magnesite, Mr. Morton went on to present data on the Pittsburgh Steel bottom which the company considers more refractory. It is also claimed to provide complete drainage of non-ferrous as well as ferrous metals and slags from the hearth, thereby reducing the possibilities of injurious bottom boils, and at the same time costing less to install than a conventional bottom. Such a bottom was installed in the No. 5 furnace, which was lit Dec. 9, 1938, and completed its run April 8, 1939.

The brick sub-hearth on this furnace was constructed as an inverted semi-elliptical arch that conformed to the general lines of the conventional bottom, with a drop of 6 in. from end slopes to the tap hole, and dropping 2 in. from front to back. The magnesite working hearth was 2 in. thick on banks and bottom. The tap hole was so constructed that its bottom conformed to the surface of the brick in

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FIG. 2—Longitudinal section of a 2000-lb. pilot open hearth, designed, constructed and operated by the Jones & Laughlin Steel Corp.



the sub hearth. This permitted complete drainage.

The sub-hearth consisted of a 3-in. layer of insulation followed by 12½ in. of clay brick, a 9-in. soldier course of chrome brick, and a 9-in. soldier course of chrome-magnesite brick. Both the chrome and chrome magnesite brick were of bonded ring construction, with a dipped and rubbed joint. The base for the finished contour of the bottom was cut out in the clay brick, 18 in. below the finished line to allow for the two rings of basic brick. All brick used were of the standard 3-in. series, and were laid up with a 50:50 Olivine-chrome mortar. No allowance was made for expansion in any part of the hearth.

Elapsed times for heating up and burning in of the hearth were as follows: 35 hr. 30 min. heating up with wood fire; 18 hr. 45 min. heating up with gas on—making a total time of 54 hr. and 15 min. for heating up. Burning in of grain magnesite required 48 hr. and 30 min., and the total elapsed time from cold furnace to charge was 102 hr. and 45 min..

During the heating up time and burning in periods, absolutely no expansion could be detected in any part of the hearth. The materials used in burning in the bottom were: for the bottom, 26,000 lb. (86 per cent) of magnesite, and 3675 lb. (14 per cent) of bar mill scale; for the banks, 26,000 lb. of magnesite was used.

Both the magnesite and mill scale were ground together in a dry pan, so that for the first shot all passed through No. 20 mesh, and subsequent shots averaged approximately 40 per cent fines. It had been planned, according to Mr. Morton, to cover the bottom and banks with this mixture to an even depth of 2 in. However, during the heating up period, the brick ribs on the front and back banks spalled, leaving little purchase for the first shot of magnesite, which slipped further down on the banks than was intended. After repreated attempts at building up the banks, it was decided to go ahead on the bottom, and to make up the banks with part of the first heat in the furnace. This procedure proved very successful and an additional 26,000 lb. of magnesite was used for this work, as already mentioned.

The saving in material and labor for the installation of this bottom compared to recent installations of the conventional type was 7.04 per cent. The savings in material, labor, and furnace time (at $60 per hr.) was 48.4 per cent. The data on one campaign for this furnace showed a total number of heats of 267; 135.29 average gross tons per heat; 36,127.70 gross tons total tonnage for the run; 13.33 gross tons per hr., tap to tap; 21.67 gross tons per 1000 sq. ft. of hearth area; 92.65 per cent yield; charge consisted of 55 per cent hot metal and 45 per cent scrap; 2.7 min. average time per heat, bottom delay for run; and 4,140,000 B.t.u.'s per gross ton of ingots, using producer gas.

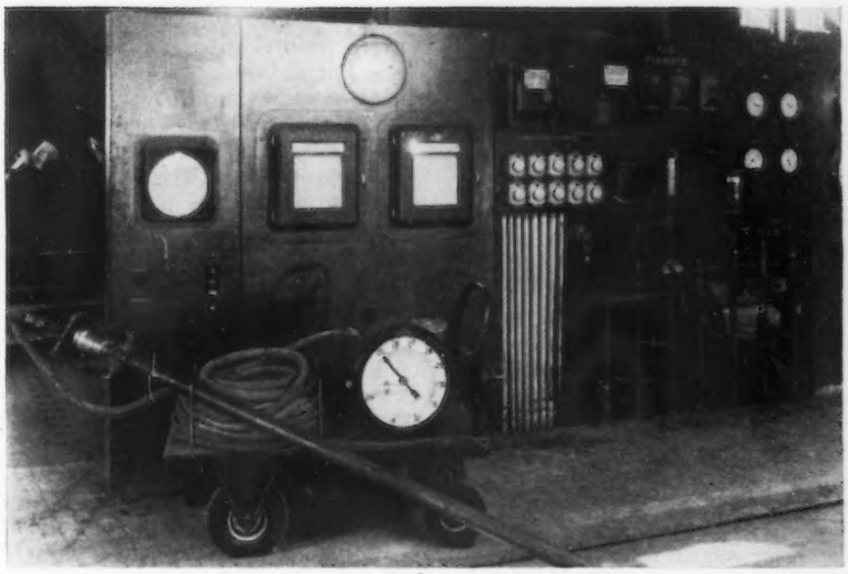


FIG. 3—New type of thermocouple designed by Leeds & Northrup for determining the temperature of open hearth baths.

There was some discussion, mixed with considerable admiration, regarding the performance of this furnace bottom, although the bulk of the discussion was delayed until Friday morning, at which time the operation of the furnace was considered in greater detail.

The next subject for discussion in the refractories session dealt with the different types of magnesite used. It was evident that there is a decided drift away from the use of Austrian magnesite. W. C. Kitto, of Pittsburgh Steel Co., reported favorable results with seawater magnesite, results every bit comparable with the Austrian magnesite. Mr. FonDersmith mentioned that his company has recently experimented with Washington magnesite, Sta-Set, Thomasite, and Russian magnesite. He mentioned particularly that Sta-Set stood up particularly well under the burners.

Another interesting discussion dealt with methods of resurfacing old bottoms, and the materials used for this purpose. The remarks of Mr. Luellen of Inland Steel Co. on this problem were of particular interest. He stated that prior to 1927 Inland used Austrian magnesite exclusively for new bottoms and for general repair work of a serious nature. After 1927 a change was made to Washington magnesite, and this has been used ever since. On comparing the bottom delays for a two-year period before giving up Austrian magnesite, there showed 19.6 min. per heat of bottom delay. For the two year period following, using Washington magnesite, the bottom delay was 18.6 min. per heat.

Inland has also put in one job of resurfacing the bottom of No. 2 open hearth, using Basefrit. This was found to go in faster, at a rate of 922 lb. per hr., against a rate of 736 lb. per hr. for Washington magnesite. On the whole new bottom, from the standpoint of labor and fuel, the saving was $157 on the resurfacing job by using Basefrit not counting the earlier time the furnace went into production. Regarding the results on the resurfacing to date, the bottom delays have been ½ min. more per heat than the shop average of all furnaces.

Undoubtedly another major subject in the afternoon session on refractories dealt with the use of basic brick and other special materials in open hearths other than for bottoms, as for instance walls and roof. Mr. Reinartz reported a communication from the British open hearth group stating that basic brick has been used abroad in open hearth roofs—Radex brick and suspended roof—the result being the securing of at least 1000 heats per roof and enabling the use of several hundred degrees more tem-

perature in the furnace, with consequent greater fuel efficiency and more rapid refining speed. Some members thought this furnace might only be a small unit, say 25 tons, and therefore not representative for furnaces such as used in this country.

However, from the discussion developed, it was evident that the use of basic brick for roofs appealed to many of the superintendents. Although they were a little skeptical of the economy of using this much more expensive construction, it was admitted that modern demands for furnace flexibility were about exceeding the capacity of silica roofs and that some trend in the direction offered by basic roofs might be desirable. All were desirous of more information along this line, but none expressed an intention of building a roof on, say, a 100-ton furnace out of magnesite brick. It was pretty well concluded, however, that if there was a trend toward a basic roof that it would be most advisable to construct the entire furnace out of basic material. It was also concluded that a basic roof would best be a suspended roof. Mr. FonDersmith expressed the opinion that the cost would be such as to not justify this construction, but certain other observations mentioned so much improvement in speed, fuel efficiency and life of roof as to suggest that considerable investigation along this line in the country might be most profitable.

Mr. Morton stated that several furnaces at Pittsburgh Steel had basic ends and the results to date were not particularly in favor of the basic brick, although he stated that he could see far more use of this material if makers were to drop the price to, say, $100 per thousand. Along this same line, the Ashland plant of Armco reported that from 120 to as high as 170 heats were secured on silica front walls, starting four courses above the sill. Similar walls of basic brick showed no great improvement, at least no improvement commensurate with the difference in cost. This same plant is at the present time experimenting with some basic brick in the roof. In a discussion of the relative heat conductance of magnesite brick and silica brick, it was pointed out that in all the mentions of magnesite brick the reference was actually to magnesia-chrome combinations rather than to magnesite alone.

Baby Open Hearth

The Thursday morning session, a combined meeting of the open hearth and blast furnace groups, was devoted to discussions on what the open hearth requires from the blast furnace, performance of mixer-type ladles, substitution of blown metal for steel scrap, etc. The afternoon was occupied by an inspection trip to Republic Steel Corp.'s 98-in. continuous strip mill, and at the fellowship dinner-smoker in the evening, Harry Sain, special representative of the Industrial Commission of Ohio, spoke on "Safety in the Open Hearth."

The Friday morning session of the open hearth group concerned itself entirely with open hearth operations. The two prominent features of this session were a description of the small pilot open hearth designed and operated by Jones & Laughlin Steel Corp., and additional data on the operation of the unique open hearth of Pittsburgh Steel Co. A partial description of this latter furnace appears elsewhere in this report.

H. K. Work, of J. & L., described the physical features of the pilot open hearth and M. H. Banta took charge of the subsequent discussion. These two men pointed out that the idea of the pilot open hearth was conceived in order more effectively to bridge the gap between the laboratory and the mill through the use of small but comparable equipment, such as is done in the chemical industry.

Lack of space prevents inclusion of full details of this furnace at this time. However, a complete report on construction and operation will appear in the stenographic report of proceedings of the Open Hearth Committee. It was first decided to make the furnace with a capacity of 1500 lb., but this later was increased to well over 2000 lb. Since the influence of the method of firing upon hearth lines is even more pronounced in a small furnace than in a large one, scaling down of the ports and burners of a large furnace, no matter how successful, was no assurance of success in a small furnace. The logical procedure to the J. & L. engineers appeared to be to design burners capable of supplying the necessary heat with a short flame, then adjust burner design, location, and hearth lines, one against the others, in order to secure best overall balance. In the J. & L. pilot furnace, this balance worked out to be an approximately circular hearth, fired by three burners specially designed by Professor Trinks, of the Carnegie Institute of Technology. The dish-shaped hearth and roughly spherical interior space efficiently conserve the heat supplied, is easy to maintain, and is convenient to work with in melting. The three short-flame burners provide efficient heating for the chosen shape of hearth.

The next problem considered by J. & L. was that of preheating the air for the burners. The three-burner arrangement, which appeared by far the most efficient method of heating, was poorly adapted to the usual regenerative design, but well suited to a one-way fired furnace. Other disadvantages of the usual reversing regenerative firing, such as lack of full control over the air supplied and irregularity of heating, due to periodic reversals, appeared likely to be more detrimental in the operation of a small furnace than in a large one. The size of the checkers computed to be necessary was found to be quite large compared to the size of the furnace itself. With all these factors in mind, it was finally decided to abandon conventional design, do away with the checkers, and build a one-way fired furnace equipped with a recuperator. The recuperator was built up of carborundum tubes, which, having a heat conductivity much higher than brick, transfer heat with considerably higher efficiency.

The lines and dimensions of the furnace may be seen in the longitudinal section drawing, Fig. 2. The bath at the slag line is square, about 4½ ft. on a side, with a dish-shaped bottom having a maximum depth of 1 ft. The silica roof brick is arched from front to back, on a 4-ft. radius, over a 6 ft. 9 in. span. The maximum height of the arch over the bottom is 4 ft. 5 in. Between the exhaust port, which is 2 ft. 1 in. by 1 ft. 8 in. high, and the recuperator is a slag pocket of considerable size, being 6 ft. 9 in. long and 21 in. below the bottom of the exhaust port. The bottom of the furnace is insulated by two courses and the front and sides by one course of insulating brick; the recuperator is insulated all over with one course of insulating brick. All side walls are three courses thick or more.

Four days were required to burn in the bottom, which was built up by fusing in successive rounds of Washington magnesite mixed with 16 per cent ground basic slag. A total of 3550 lb. of magnesite was required to build up the bottom to a thickness of 6 in. in front of the tap hole. Magnesite is used, in repairing, for patching.

The furnace is charged by hand; a typical charge includes 50 per cent cold pig and 10 per cent stone. Approximately 2½ hr. are required to

(CONTINUED ON PAGE 78)

Observations on High Speed Steel

(CONCLUDED FROM PAGE 45)

number of so thin a layer as 0.0005 in. would not permit the use of a surface so crudely prepared. This is quite true and consequently such tests as the Bierbaum Microcharacter test requires a surface that has been micropolished. Consequently, the hardness testing of small surface thicknesses would be of a laboratory nature. However, the great strides that have been made toward smoothness in commercial steel surfaces (a good example is the process of "Superfinishing" recently developed by the Chrysler Motor Corp.) would indicate that commercially there may be developed a surface sufficiently smooth to permit of testing it by a method sensitive enough to gage the hardness of thin layers of surface.

A Superior Heat is Possible

Some heats of high speed steel appear to possess some quality such that tools made therefrom show outstanding cutting performances as compared with similar heats of steel. Such heats of steel are probably a rarity, if they do indeed exist, although there was a time, not too far distant, when such heats were either encountered or the feeling was held that they did exist. Today, high speed steel probably does not exhibit so many vagaries as were to be found in the high speed steel of some 20 years ago. On the other hand, some vagaries are encountered today which did not exist 20 years ago.

The writer has observed only one heat of high speed steel for which it was believed there was sufficient evidence to indicate that tools made from it possessed a cutting quality superior to companion heats of steel. Sets of tools made from the apparently exceptional heat of steel were reported by several widely scattered users as giving a consistently superior performance. These tools were used by industries making highly specialized and exacting products where tool performance records are scrupulously maintained. Also the reports covered comparisons of tools which were finish ground all over and tools which were milled and treated. Because of the exacting requirements of this particular class of tool, detailed manufacturing records of each set are made. Thus, it was possible to trace the various sets of these tools even to the day the tools were treated nine months previously, the particular furnaces through which they passed, etc. It was found that the tools made from the superior heat and "normal" heats were, in some cases, treated the same morning or afternoon in the same furnaces; in fact, were processed as one lot throughout manufacture.

The analyses of the superior heat and the several "normal" heats with which the former was compared are given in Table IV. These analyses are so close in all the usual elements as to be almost identical from the standpoint of analysis.

All the tools showed equivalent Rockwell C values. The mill records of the manufacture and processing of the steel showed no indication of anything unusual. The microstructures reproduced in Figs. 7 and 8 show little difference. Microstructures taken at 500 diameters show the comparative structures near cutting edge (Fig. 7) and comparative structures half way between outside and middle of tool (Fig. 8). The grain sizes are practically identical as might be expected from the record which showed the tools to have been hardened in the same furnaces the same day.

Numerous other comparative tests were made on tools made from the superior and "normal" heats of steel. The only difference noted was that indicated in the micrographs of the structures near the edges. The superior tools showed a smaller amount of the larger carbides. This would be expected to contribute to superior performance, but the structural differences are not of a sufficiently great magnitude to draw a definite conclusion. It can only be surmised that carbide, and its size and distribution, may be the reason, or one of the reasons for the superior performance of tools made from this heat of steel.

The foregoing has been a necessarily abridged description of some observations on the processing of material representative of 702 heats of 18-4-1 high speed steel. It is the accumulation of such data that determines how one consumer might develop his specifications and tests for future material.

En passant, an interesting, though somewhat annoying item which does not appear to be a heat characteristic is the occurrence of hard spots near the surface of the steel, which are due to a cause other than that of carbide segregation.

These hard spots, with but two exceptions, all occurred within the first 1/32 in. of the bar surface. In the two exceptions noted, the hard spots extended 0.105 in. under the surface of a bar 7/8x2 in. These hard spots, of which 27 cases were noted, were never encountered prior to 1937. Steel furnished in 1937 and the first half of 1938 accounted for nearly all the 27 cases. Incidentally, the hard spots were encountered in steel from more than one source of supply.

Fig. 9 is a photograph of two samples of high speed steel containing hard spots. These two examples of hard spots were about 0.10 in. below the surface of the original bar. The left-hand sample shows a hard spot on the surface as taken from the milling machine; the right-hand sample was roughly polished. Both samples were etched in 5 per cent Nital for contrast prior to photographing. The black spots within the hard "island" of the right hand samples are Rockwell C impressions. The line crossing the lower part of the hard spot is a crack. The hard spots showed a Vickers-Brinell number of 740. Re-annealing samples containing these hard spots did not alter the hardness.

As many as six hard spots have been reported on one size of steel from the same heat. Other sizes made from the same heat of steel have appeared to be free from hard spots. In other cases only one hard spot has been reported on steel representative of a single heat. The occurrence of hard spots is irrespective of the carbon content of the steel, size or bar shape.

The micrograph, at 500 diameters shown in Fig. 10 (left), is an etched cross-sectional view of the hard spot shown in the right-hand side of the photograph in Fig. 9. Cracks in the hard spot may be observed. Note how the high speed steel itself merges with the hard area on the right-hand side of the micrograph. Fig. 10 (right) is another view, at 500 diameters, of the top side of the hard spot near one end. A crack traverses the hard spot which appears quite definitely merged by fusion with the base high speed steel.

What causes these hard spots is not definitely known. Every one agrees that the hard areas are fused to the high speed base and that they are probably a ferroalloy. How or why these hard spots occur, and why they always occur near the surface is still something of a mystery.

THIS WEEK ON THE ASSEMBLY LINE

° ° °

By W. F. SHERMAN
Detroit Editor

° ° °

. . . Auto production passes spring peak . . . May estimated at 330,000 units . . . Crosley midget car a "stripped" job with little interior trim . . . Chrysler announces modernization of Los Angeles plant . . . Henry Ford says tractor manufacturing will begin at Rouge plant.

DETROIT—Automobile production in the past week dropped sharply enough to lead to the general assumption that the peak of spring assemblies has been passed. Further, there are indications that a few of the plants are ready to taper production quite sharply within the next few weeks. Other plants are expected to prolong their activities as much as conditions permit. The reason that a few plants will close down shortly is that their dealer organizations have plenty of cars to take care of expected volume. The other plants, which already are on virtually a week-to-week basis, gaging production by recorded sales and orders, will be able with care and foresight to keep going through July.

Ward's Automotive Reports in its weekly statistical summary emphasizes that current assemblies are readily susceptible to the rate of retail deliveries, so minor fluctuations are quite likely. The estimate for last week's assemblies is 86,640, compared with 90,280 in the previous week and 50,755 in the corresponding week of 1938.

The 1938 record of production is comparable to this year, although the production levels a year ago were considerably lower. Then, the April peak of more than 58,000 per week at mid-month showed steady declines to 45,000 per week in May, 40,000 per week in June and 25,000 or less per week in July. This is not at all like the good year 1937 when March weekly totals of about 100,000 increased to 140,000 per week in April and part of May—with the totals holding above 100,000 per week even into July.

Estimated output for May is 330,000 units (in 23 working days) compared with assemblies of 355,000 units in 20 working days of April.

The downturn last week was due chiefly to resumption of four-day schedules by Plymouth and Dodge after one week at five days. Ford, Mercury, Lincoln Zephyr and Chevrolet maintained previous levels. The Plymouth drop was from 11,700 to 8750.

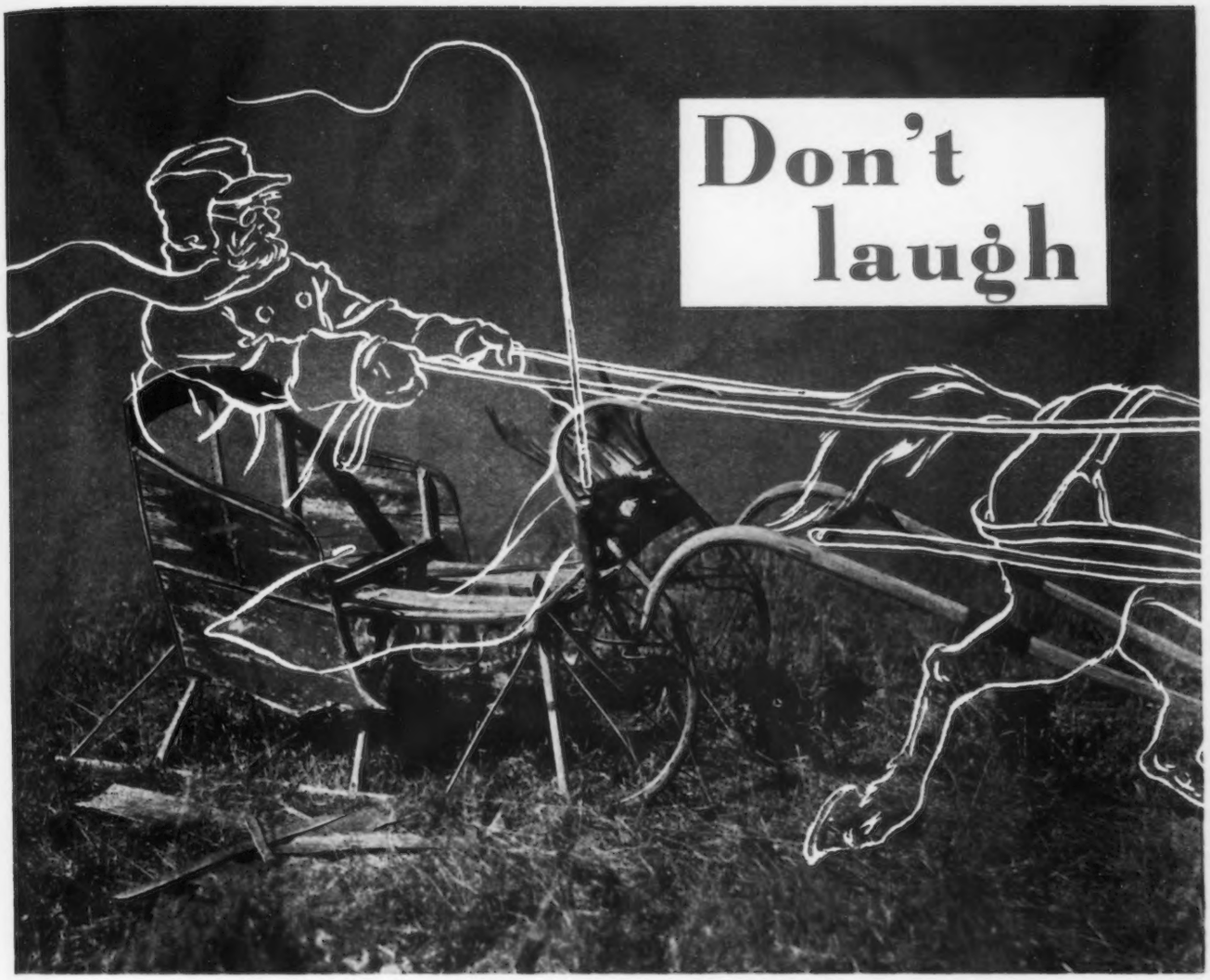


Source: U.S. Dept. of Commerce (1929-31=100)

New Crosley Car Shown

A break with tradition is seen in the new Crosley car which made its bow at the Indianapolis Speedway last Friday. Powell Crosley, radio manufacturer, declared that he is not attempting to compete with the Big Three in the new car market. Crosley defies the traditional automotive distribution set-up by offering his vehicle through Crosley radio dealers. He adds to the newness of his approach by refusing to accept trade-ins of any sort. Other variations from previous standards set up in the automobile industry include the use of an aircraft-type engine, turning 4300 r.p.m. to produce 15 hp., the elimination of universal joints by an unusual flexible mounting of the power plant, and the virtual elimination of steel inner-body panels as well as elimination of all decorative or protective upholstery, trim, etc. However, Crosley has developed a special midget radio for the car.

Outside, the car has just about what one would expect to see, but inside there is little that is conventional. The seat frames stand open to the gaze, with only light pads for cushioning (although a coil spring pad is pro-



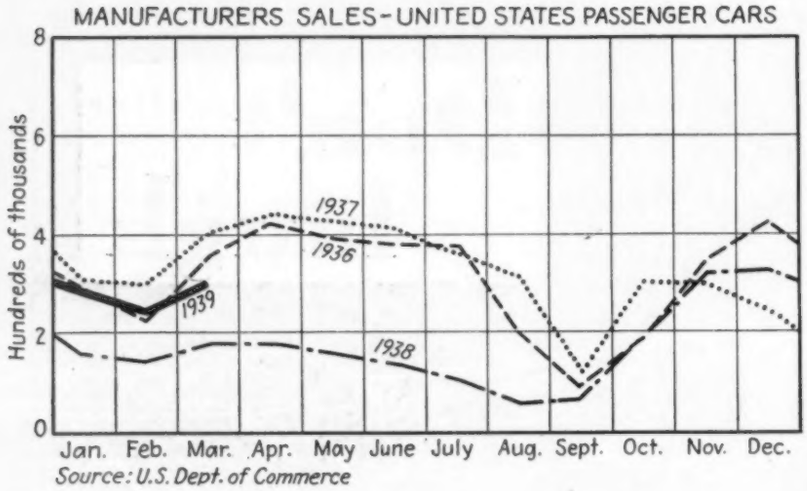
There are hundreds of machine tools just as obsolete in American shops today . . . . .

THE WORST thing about obsolescence is the insidious way it creeps up. Days grow quickly into years, and suddenly that "new" machine is worn out. The most surprising part is the honest belief of most shop owners that "it couldn't happen here." Time and again we see machines limping along that should have been scrapped years before. We *know* that the money spent keeping those machines going, plus the savings that could be made, would pay for the necessary new equipment in short order. And the time is coming—soon—when American shops will have to operate at full capacity. When that happens, machine tool cripples will be dangerous bottle necks.

We have many highly trained experts who can help you intelligently in working out a plan to weed out your obsolete equipment. Their services cost you nothing. Let them apply their knowledge of modern production tooling methods to your problems. Pratt & Whitney accuracy has paid its way many times. There is no better paying investment than the right tools for the job.

Pratt & Whitney

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Source: U.S. Dept. of Commerce

vided under the rear seat). Doors, body panels and floor panels are for the most part single sheet steel thickness, painted on both sides, with no attempt made to hide structural joints or fender attachments.

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(CONTINUED ON PAGE 81)



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By L. W. MOFFETT
Washington Editor, The Iron Age

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Inclined to "Liberal" Side

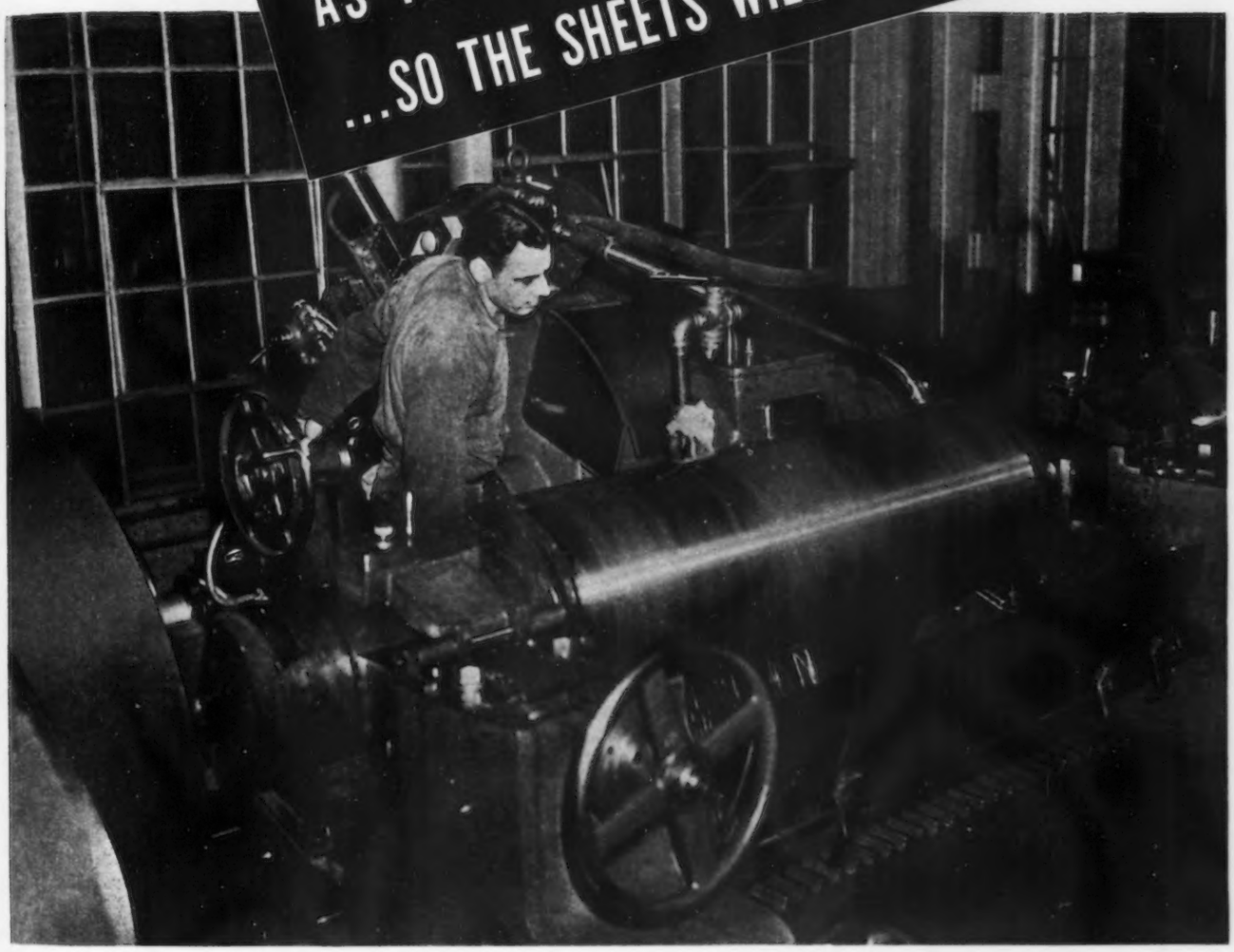
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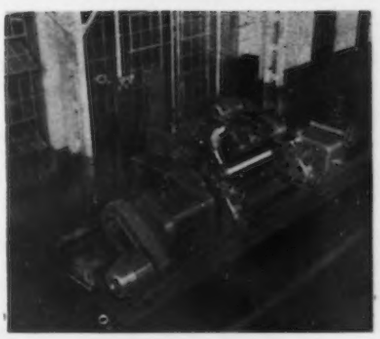
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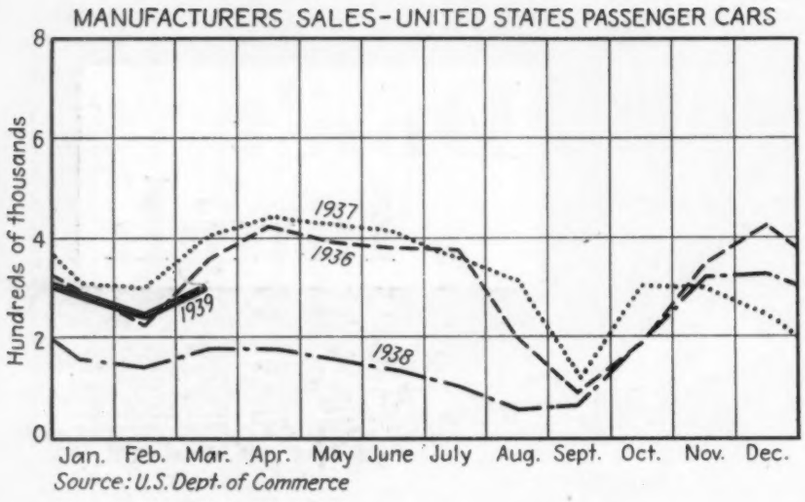
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CINCINNATI, OHIO, U. S. A.



Source: U.S. Dept. of Commerce

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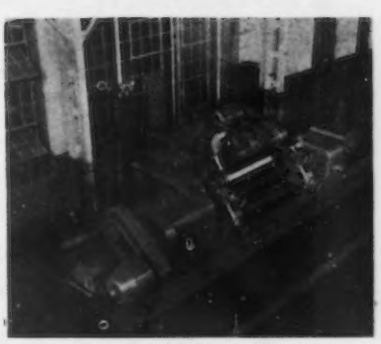
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Monopoly Committee Unlikely To Hear Steel Before Autumn

WASHINGTON—The iron and steel industry's case before the Temporary National Economic Committee will not be presented earlier than fall, according to the tentative schedule of the committee. Under the program announced by Senator Joseph C. O'Mahoney, chairman, industry groups generally will not tell their stories until after summer recess, which will be taken early in July. When the committee resumed hearings on Monday milk distributers, farmers and labor at their request started presentation of the evidence to offset Federal Trade Commission testimony. The petroleum industry will be permitted to submit its case before recess. Otherwise all industry groups will have to wait until hearings are resumed after the recess period to submit their testimony in reply to Government evidence. The two Government agencies participating in the steel case are the Federal Trade Commission and the Department of Justice.

Onslaught Already Made

The commission has made its onslaught against the industry. Presenting old material it simply maintained its traditional stand in charging there is no competition in the industry. Alleging that the basing point system is responsible for the "monopolistic" practices of the industry, the FTC again demanded that the industry be compelled to establish an f.o.b. mill price policy. On the other hand, the Department of Justice has undertaken a current as well as a historical study of the industry. While ostensibly the FTC has joined it in sending out two questionnaires to the industry, in reality they are being sponsored and returns will be analyzed by the department as part of its steel presentation. Returns from practically all small steel companies have been received and are beginning to be made by the larger producers in connection with the first questionnaire. It relates to prices and distribution of 10 principal steel products in February, 1939. These are being analyzed and interpreted. It is not known when the department will be prepared to present this and other material being gathered. It is reported that at least a portion of the department steel study will be submitted to the TNEC soon, though the tentative schedule makes no specific provision for steel evidence by the department.

Beryllium on Schedule

It will, however, delve into a nonferrous metal line beginning next Monday with a presentation on beryllium, now receiving much public attention because of what Senator O'Mahoney called its "strategic importance in current industrial and military practice."

Indicating the character of the beryllium study, Senator O'Mahoney said:

"The Department of Justice hopes to cast light upon those obstacles which a new industry finds in the development stage. The hearing will involve questions of price, international agreements, patents, uses in military aircraft, the significance of invention, economic controls, and other matters as they relate to an industry of this unusual character. While beryllium is not widely known, it is among the most important of the newer metals. It is the second lightest metal and achieves its significance as an alloy with copper and nickel, where small additions of beryllium produce remarkable changes in the characteristics of these metals."

Thorp Heads Cartel Study

Later the workings of steel and other cartels as operated abroad will be explained to the committee. The cartel study is being made by the Department of Commerce under the direction of Dr. Willard Thorp, economic adviser to Secretary Hopkins. It is understood that the showing will be strongly against cartelization of industry in the United States because of price-fixing and quota arrangements, which, it is charged, may lead to Government dictatorship. The particular significance of such showing has not been made clear since so far as is known there is no movement in this country toward domestic cartelization, though some American industries are associated to some degree with foreign cartels as they affect international trade. Senator O'Mahoney disposed of the cartel study merely with the generalization it is the purpose to show in which manner the so-called "cartel" has gained a dominant position in the organization of European business. He pointed out the relationship which exists between

the individual business man and organized industry will be developed, "particularly with respect to the effect of Government policies upon both."

Building Construction Studied

At the conclusion of these hearings, the Senator said it is hoped the committee will then be in a position to present the results of its study of building construction.

"For weeks past an intensive investigation has been in progress into the possibility of further stimulating building construction throughout the country, reasons for the lag which has been heretofore noted, and the views of qualified persons as to what may be done to alleviate the situation," he said.

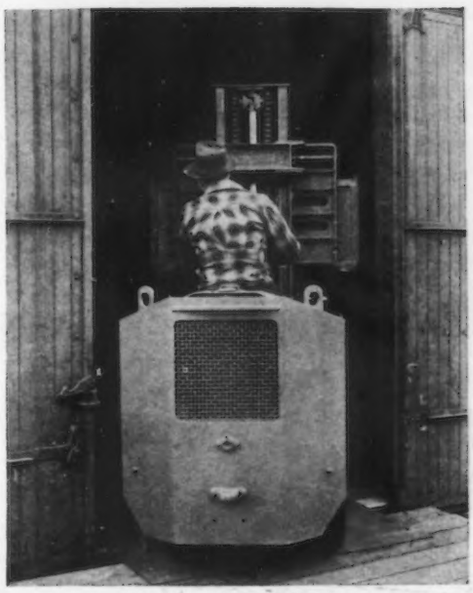
Meanwhile the growing coolness of Congress toward the TNEC was plainly shown last week when it slashed its appropriation from $600,000 to $120,000. The Senate had voted the former sum but the House shaved it to the lesser amount. The Senate quickly fell in line with the House. It is probable, however, that most if not all of the original total will be granted—reluctantly. O'Mahoney is to ask for restoration of the $600,000 when he appears before the House Committee on Appropriations. He said he had agreed to the cut at the request of House members who felt that the appropriation should not be granted without committee hearings.

The fact is that Congress, responsive to public sentiment, has soured on the committee, feels there never was any reason for its creation and that it has done nothing to justify squandering of the taxpayers' money. Congress is finding that John Q. Taxpayer is becoming increasingly squeamish over the waste of his money.

Grinding Wheel Standards Revised

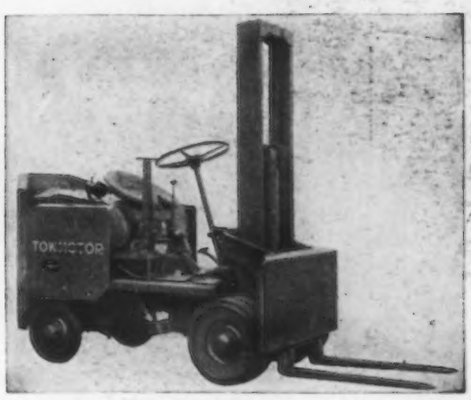
WASHINGTON—A revision of the simplified practice recommendations covering grinding wheels, eliminating certain items on which demand has fallen off and adding others which have come into active use in recent years, has been approved by the Bureau of Standards, to become effective on June 1. The new recommendations, copies of which are available at the bureau in Washington, bring previous revisions made in 1927, 1928 and 1932 into line with current requirements and reduce the variety of wheels to a number regarded as adequate for normal requirements.

CAR LOADERS?



NEW MODEL C-L, 47" WHEEL BASE, LOAD CAP. 4000 LBS.

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STANDARD MODEL L, 53¼" WHEEL BASE, LOAD CAP. 6000 LBS.

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C-I to Lease Navy Ordnance Plant

WASHINGTON — To enable Carnegie-Illinois Steel Corp. to accelerate deliveries of light weight heat treated plates, the Navy Department will lease a small part of the naval ordnance plant at South Charleston, W. Va., consisting of a few heating furnaces installed in one of the buildings. The plates will be rolled at the company's Homestead works, shipped to South Charleston for heat treatment and returned to Homestead for finishing.

Other action taken by the Administration last week to speed up its armament program included:

(1) President Roosevelt signed into law the $549,000,000 War Department Appropriation Bill.

(2) The War Department made awards to five companies for 571 bombing, pursuit and interceptor airplanes to cost $50,000,000 and placed additional orders for engines and spare parts.

(3) President Roosevelt asked Congress to appropriate $31,621,000 to start immediate construction of a chain of naval air bases in the Pacific, Alaska, Puerto Rico and continental United States, and to authorize the awarding of contracts to complete the entire $66,800,000 program for the bases. Including these requests, together with others already granted or pending, the amount considered this year for the navy by the House Appropriations Committee was estimated by Representative Scrugham, naval subcommittee chairman, to amount to more than $800,000,000.



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Germany's Magnesium Production Increases

WASHINGTON—Magnesium production in Germany showed a marked increase in 1938, according to a report from Consul S. B. Redecker, Frankfort-on-Main, to the Department of Commerce. This development, it is pointed out, is one of the results of the present German program of replacing imported materials wherever possible with those domestically produced.

While no official figures are available, it is estimated that Germany's output of magnesium last year amounted to between 12,000 and 13,000 metric tons against about 10,000 tons in 1937. World production for 1937 was 18,000 tons.

Higher Lead Output Forecast for Austria

WASHINGTON — Sharply expanded production of lead in what was formerly Austria is anticipated under the stimulus of Germany's "Four Year Plan," the Department of Commerce reports. Austrian lead output formerly was restricted by the relatively high cost of production but these hindrances are reported to have been removed by the incorporation of Austria into Greater Germany.

Bill Would Permit 5-Year Housing Census

WASHINGTON — A national census of housing would be undertaken in 1940 as part of the population census, and every five years thereafter, under a bill just introduced in Congress by Senator Robert F. Wagner, Democrat of New York.



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Super-Highways Across U.S. Opposed By Roads Bureau

WASHINGTON — Transcontinental super-highway plans proposed in Congress for the past several years were frowned upon last week by the Bureau of Public Roads, which recommended instead a master highway plan calling for the construction of special, inter-regional highways through a broadened Federal-aid highway system.

In a comprehensive report appraising existing highway needs, the bureau said that three East-West and three North-South express highways, as suggested by Congressional members last session, would cost $184,050,000 annually and could be expected to yield only $72,140,000 each year in tolls. It suggested that should Congress wish to experiment further that it authorize the construction of a super-highway connecting Washington and Boston, on which it said there is "a reasonable prospect" for recovering costs because of traffic volume.

The master highway plan, calling for joint contributions of Federal and state governments, proposed:

(1) The construction of direct inter-regional highways to meet national defense requirements and peace-time traffic needs;

(2) Modernization of the Federal-aid highways system;

(3) The elimination of hazards at railroad grade crossings;

(4) The improvement of secondary and feeder roads; and

(5) The creation of a Federal Land Authority empowered to acquire, hold, sell and lease lands needed for public purposes and to acquire and sell excess lands for the purpose of recoupment.

The average annual Federal expenditure for highway construction under the present Federal-aid highway system has been at the rate of $298,000,000 a year since 1933. Federal appropriations for highway construction averaged $100,000,000 a year for the previous five-year period.

The Bureau of Public Roads estimates that for every $100,000,000 spent for highway construction 107,000 tons of iron and steel are used and the value of business placed for iron and steel products, $16,317,500.

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F. L. Llewellyn Honored For Research in Steel

WASHINGTON—F. L. Llewellyn, research engineer of the United States Steel Corp., addressed 150 members and guests of the Washington section of the American Welding Society at the Lafayette Hotel on Tuesday night of last week, making an interesting talk on "Seventy Years in Retrospect." Mr. Llewellyn will retire June 1 after nearly 50 years of service with the steel corporation. A past president of the American Welding Society, warm tributes were paid to his outstanding contribution in the art of structural steel welding development, and the resulting increased importance of steel in housing and many other fields. His address traced his own experience in the use of steel in structural engineering, and spanned the growth of welding from its infancy to its present-day high rank in construction.

Roosevelt Proposes Plan for Merger of Government Agencies

WASHINGTON—President Roosevelt took initial steps last week to inaugurate his long-cherished Government reorganization plan by sending to Congress a message calling for the inclusion of four agencies under direct White House supervision, and for the consolidation of most existing bureaus into three central agencies.

Putting into motion the machinery provided in the Reorganization Act passed by Congress earlier this session, Mr. Roosevelt estimated in his message that the savings in administrative cost would approximate $15,000,000 and $20,000,000 because of anticipated improvements in overall managements, improvements within departments and in the allocation of departmental activities. That amount was substantially less than what many members of Congress had expected of the plan in the way of savings, and some observers were skeptical that the shake-up will eventually result in few substantial reductions in Government overhead.

Three Central Agencies

The three central agencies and the bureaus over which they will have jurisdiction under Mr. Roosevelt's plan are:

Federal Security Agency — Social Security Board, Labor Department's United States Unemployment Service, Treasury's Public Health Service, WPA's National Youth Administration, and Civilian Conservation Corps.

Federal Works Agency — Agriculture's Bureau of Public Roads, Treasury's Public Buildings Branch and Procurement Division, building management branch of the National Park Service, Interior's United States Housing Authority and Public Works Administration. The Works Progress Administration will become a subordinate unit, retaining its present WPA identity but undergoing a slight change to Works Projects Administration.

Federal Loan Agency—Reconstruction Finance Corp., Electric Home and Farm Authority, Federal Home Loan Bank Board, Federal Housing Administration and related agencies and boards, including the Export-Import Bank of Washington.

Each of the three agencies will be headed by a Presidential appointee, who is subject to Senate confirmation, to be paid $12,000 a year.

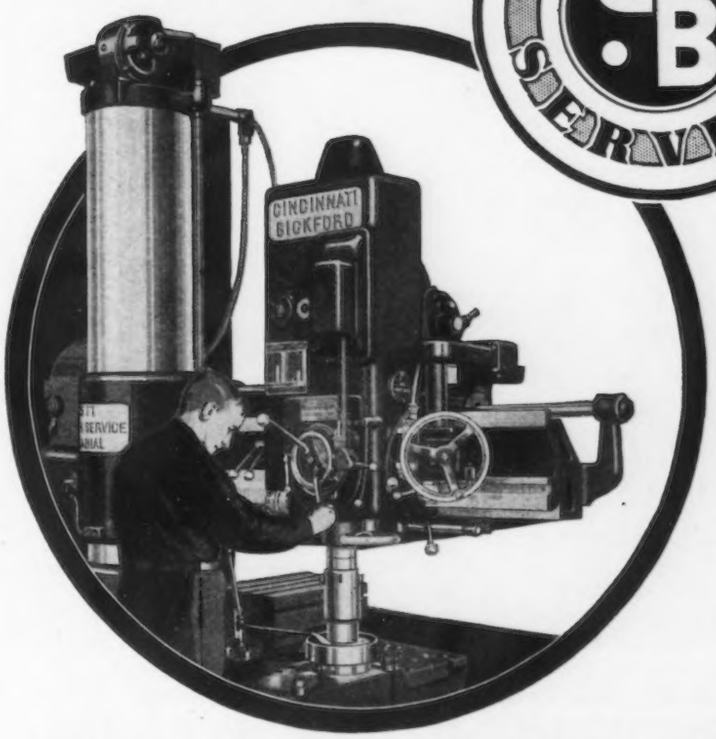
The Farm Credit Administration, the Federal Farm Mortgage Corp., and the Commodity Credit Corp. would be included under the Agriculture Department; and the Budget Bureau, the Central Statistical Board, the National Resources Committee and the Commerce Department's Federal Employment Stabilization Office would be subjected to direct White House supervision.

An Idea Long Held

Mr. Roosevelt's reorganization plans are said to date back to the days when he was Assistant Secretary of the Navy under the Wilson Administration. Even before his controversial reorganization bill—the measure which was described as "a wolf in sheep's

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clothing," and which went down to defeat in one of the outstanding Administration losses of last session—was drawn, he was known to be interested in stream lining the Government's antiquated administrative machinery. He occasionally expounded the view that no business man would long tolerate the cumbersome machinery of the Federal variety in the operation of a large private enterprise. The threat of vesting dictatorial powers in the Chief Executive is generally credited with having defeated the measure.

The present plan, which represents a modification of the reorganization measure of last session and which will go into effect automatically at the end of 60 days if no opposition develops in Congress, was expected to provoke the most resentment within the affected Federal agencies, where recipients of Government pay checks interpreted the move as a threat to the security of their jobs.

Some of them compare the present move with the economy program inaugurated by President Roosevelt early in his Administration, and recall that the economy wave finally gave way to an unprecedented expansion that sent Government payroll figures to an all-time high and required the facilities of another agency to record New Deal progress and advise one-half of Washington what the other half was doing.

The President plans to send two other messages to Congress on the subject of reorganization. One will cover inter-departmental changes; the other intra-departmental alterations.



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Reich's Machinery Exports To South America Top U. S.

WASHINGTON—The Commerce Department's Machinery Division reported last week that Germany increased her exports of metal-working machinery to the eight most important Latin-American markets by 30 per cent during 1938 and now ships almost twice as much of this equipment to these countries as does the United States.

Germany's 1938 sales were $4,088,294 against $3,151,591 in 1937 and United States sales $2,093,632 in 1938 against $2,297,345 in 1937.

In 1938 the chief Latin-American markets for metal-working machinery in the order named were: Brazil, Argentina, Chile, Mexico, Colombia, Uruguay, Venezuela, and Peru. The United States supplied the largest quantity to Mexico, Colombia, Venezuela, and Peru. Germany was the major supplier to the others.

Exports of farm equipment from the United States in March were valued at $6,571,059 compared with $7,106,178 in March, 1937. Reduced foreign shipments were recorded in most types of equipment.

NLRB Dissolves Another Non-CIO Union

WASHINGTON—The National Labor Relations Board has announced an order, based upon a stipulation, requiring Metal Door & Trim Co., LaPorte, Ind., "to disestablish the Hollow Metal Workers Union, and to stop discouraging membership in Lodge 1690, Amalgamated Association of Iron, Steel and Tin Workers of North America, through Steel Workers Organizing Committee, affiliated with the CIO, or any other labor organization of its employees."

Government Awards For Week Ended April 22

WASHINGTON — Government awards under the Walsh-Healey Act for iron and steel products during the week ended April 22 totaled $510,973.18, while machinery awards aggregated $251,691.51. Details of these and related awards follow:

Iron and Steel Products

National Tube Co., Washington, flasks, steel	$59,580.60
Erie Forge Co., Erie, Pa., steel forgings	59,025.00
Ceco Steel Products Corp., Jersey city, steel sash and casement doors	12,458.00
Edward G. Budd Mfg. Co., Philadelphia, doors, hatches	124,012.96
Bethlehem Steel Co., San Francisco, reinforcing steel	134,263.00
Crucible Steel Co. of America, New York, steel, bar and strip	Indefinite
Carnegie-Illinois Steel Corp., Washington, steel, bar and strip	35,490.00
The Youngstown Sheet & Tube Co., Youngstown, steel, bar and strip	23,290.00
Wire Rope Corporation of America, Inc., New Haven, Conn., flexible cable	12,354.00
Morse Chain Co., Ithaca, N. Y., roller chain	13,380.00
Joseph T. Ryerson & Son, Inc., Chicago, fire tower steel	14,257.62
Steel Construction Co., Portland, Ore., revolving fish screens	22,862.00

Non-Ferrous Metals and Alloys

Aluminum Co. of America, Washington, aluminum-alloy	$15,480.79
Scovill Mfg. Co., Philadelphia, blanks, nickel	50,750.00
Aluminum Co. of America, Washington, magnesium, flat	25,340.00
The Fyr-Fyter Co., Dayton, Ohio, fire extinguishers	37,044.00

Machinery

Worthington Pump & Machinery Corp., Washington, air compressors	$28,088.00
Consolidated Machine Tool Corp., Rochester, N. Y., rolls, plate straightening	19,950.00
Stedfast & Roulston, Inc., Boston, boring machine	13,455.00
Brown & Sharpe Mfg. Co., Providence, milling machines	10,430.00
The Carlton Machine Tool Co., Cincinnati, drilling machine	11,036.60
James M. Motley & Co., Inc., New York, forging machine	11,497.00
Jones & Lamson Machine Co., Springfield, Vt., turret lathes	10,284.00
Worthington Pump & Machinery Corp., Washington, pumps	13,264.40
Worthington Pump & Machinery Corp., Washington, centrifugal pumps	101,268.20
Caterpillar Tractor Co., Peoria, Ill., tractors, scrapers	32,418.31
Singer Sewing Machine Co., New York, sewing machines, parts	Indefinite

Transportation Equipment

United Aircraft Corp., Pratt & Whitney Aircraft Division, East Hartford, Conn., parts and tools for aircraft engines	$200,000.00
Wright Aeronautical Corp., Paterson, N. J., aircraft engine parts	12,215.75
Wright Aeronautical Corp., Paterson, N. J., engine parts	34,554.25
Breeze Corp., Inc., Newark, N. J., starters, cartridge	10,917.00
United Aircraft Corp., Hamilton Standard Propellers Division, East Hartford, Conn., propellers and governor units	89,746.66
Fargo Motor Corp., Detroit, sedans	54,267.76
General Motors Corp. (Chevrolet Division), Detroit, trucks	26,487.60
International Harvester Co., Washington, trucks	11,827.00
General Motors Corp. (Chevrolet Division), Detroit, trucks	16,371.08
Continental Motors Corp., Detroit, miscellaneous engine parts	12,407.20
Stewart Motor Co., Washington, ambulance	80,690.28

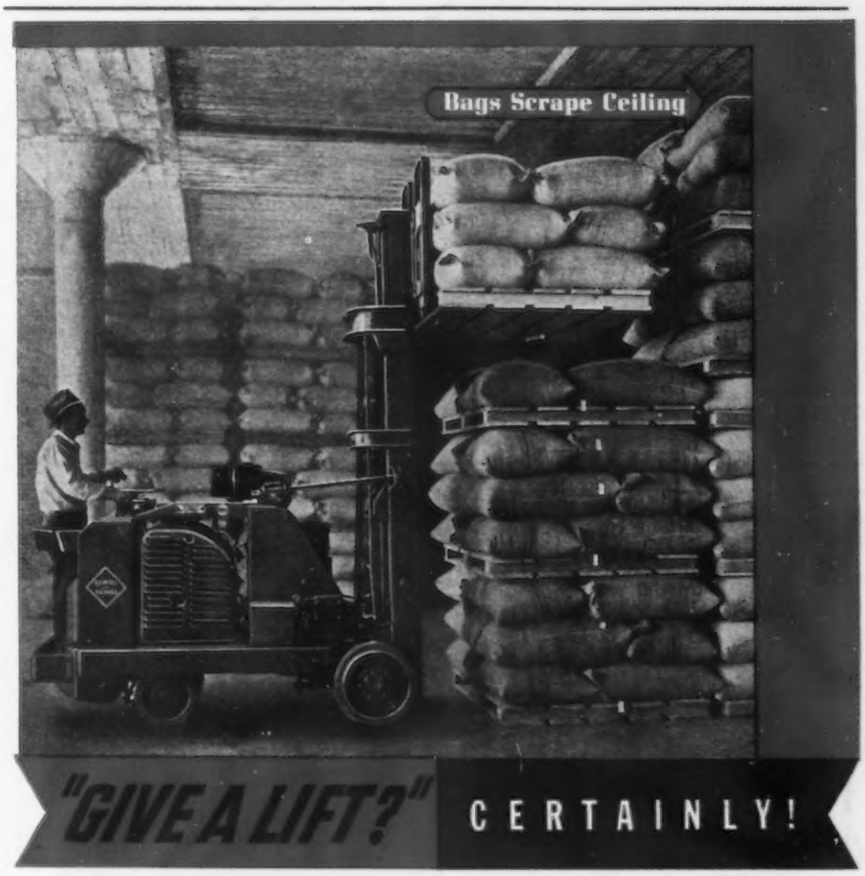
House Votes $100,000,000 for Strategic Materials

WASHINGTON—The House last week authorized an expenditure of $100,000,000 for the next four years for the procurement of strategic and critical materials, particularly manganese, tin, chromium and tungsten and other war-time essentials. The Senate had previously authorized a $40,000,000 appropriation in deference to a White House request.

Also included in the measure passed by the House was a provision to permit war-debtor nations to supply us with some of the requirements and to apply the amounts involved toward liquidating the debt, but members admitted that this provision was at best only "a gesture."

After two hours of debate over the question of stimulating domestic sources of supply, the House put its stamp of approval on an amendment requiring the War Department to purchase from domestic sources wherever possible.

Recommended was a stock pile of 554,000 gross tons of manganese ore; 250,000 gross tons of chrome ore;



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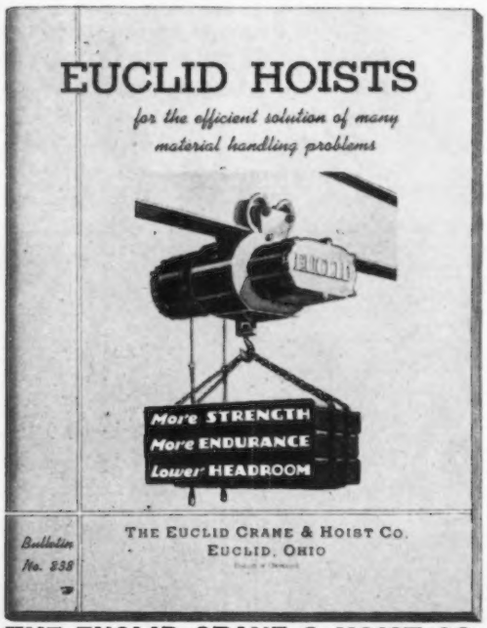
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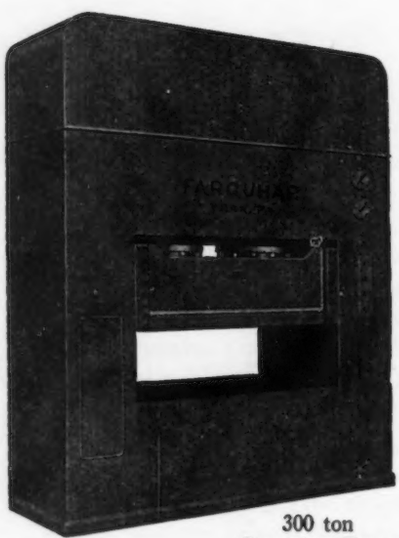
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3350 tons of tungsten ore, and 85,000 tons of tin.

Allis-Chalmers Builds New Pittsburgh Plant

THE Allis-Chalmers Mfg. Co., Milwaukee, has awarded contracts to build a new transformer plant in Pittsburgh. This plant, which will be known as the River plant, of Allis-Chalmers Pittsburgh works, will measure 416 x 144 ft., will cost with buildings and equipment about $378,000 and will be put into operation about Aug. 15. The plant will be set up on a line production basis and will represent the latest manufacturing methods as applied to the production of distribution transformers.

H. M. Siesel Construction Co. of Milwaukee and Pittsburgh has been awarded the general contract and steel will be provided by Bethlehem Steel Co.

First Quarter Scrap Consumption Climbs

CONSUMPTION of scrap iron and steel in the first quarter of 1939 is estimated at 7,158,465 gross tons by the Institute of Scrap Iron and Steel, Inc., New York. This compares with 4,102,819 tons in the first quarter of 1938, and shows an increase of 74.7 per cent for the 1939 quarter. This is in keeping with increased steel mill and foundry activity.

Meanwhile, exports of scrap in the first quarter of 1939, at 758,361 gross tons, were 19.9 per cent less than the first quarter of 1938, when 946,150 tons were shipped abroad, the institute said.

Golf Clubs Took 534 Tons of Steel in '39

GOLF, a game in which little steel was once used, last year absorbed about 1,069,000 lb. in the manufacture of new golf clubs, exclusive of other uses on the golf courses. Of the total for golf clubs, 175,000 lb. of steel was used for the shafts of wood-headed clubs, while 894,000 lb. was used for the shafts and heads of irons. On the golf courses, indeterminate amounts of steel were used for pins to mark the steel cups, and for watering equipment, pails, mowers and other machinery for upkeep.

The Trane Co., La Crosse, Wis., is erecting additional buildings to provide approximately one-third greater floor space. Need for new manufacturing facilities was necessitated by additions to the Trane line of air conditioning products.

Steel Industry Loss Last Year $14,879,000

THE steel industry's net loss in 1938 was $14,879,000 after all charges but before dividends according to reports received by the American Iron and Steel Institute from nearly 100 companies with more than 90 per cent of the industry's total output. These companies earned $228,276,000 in 1937.

Last year was the fifth year since 1930 in which the industry "went into the red." In 1935 through 1937 the industry operated with a profit but from 1931 through 1934 and again in 1938 receipts failed to equal expenses.

Earnings in the three profitable years offset by only a narrow margin the losses in the other five years of the period, and the industry's return on investment since 1930 has averaged but 1.2 per cent.

Total 1938 payrolls, including some subsidiaries which do not produce iron or steel products, amounted to $730,367,000, compared with $1,118,131,000 in 1937. The total of $48,952,000 in dividends paid during 1938 represented a return of 2 per cent on the value of common and preferred stocks outstanding, while dividends of $149,488,000 in 1937 were equivalent to a return of 5.7 per cent.

Scottish Companies Agree on Merger

LONDON—An agreement has been reached for a link-up between William Baird & Co., Scottish iron and coal concern, and the Scottish Iron & Steel Co. Combined capital of the two concerns is £3,800,000 ($19,000,000).

A new company will be formed to take over the blast furnaces, coke ovens and colliery interests of William Baird in Lanark, Stirling, Dumbarton and West Lothian counties, and the entire Scottish Iron & Steel undertaking.

The chief gain to William Baird, which will become a holding company, will be economies in working, while it is understood that coke oven gas produced at Baird's Gartsherrie works will be used as fuel by Scottish Iron & Steel. Difficulty in finding an outlet for this gas has hitherto retarded the modernization of these works.



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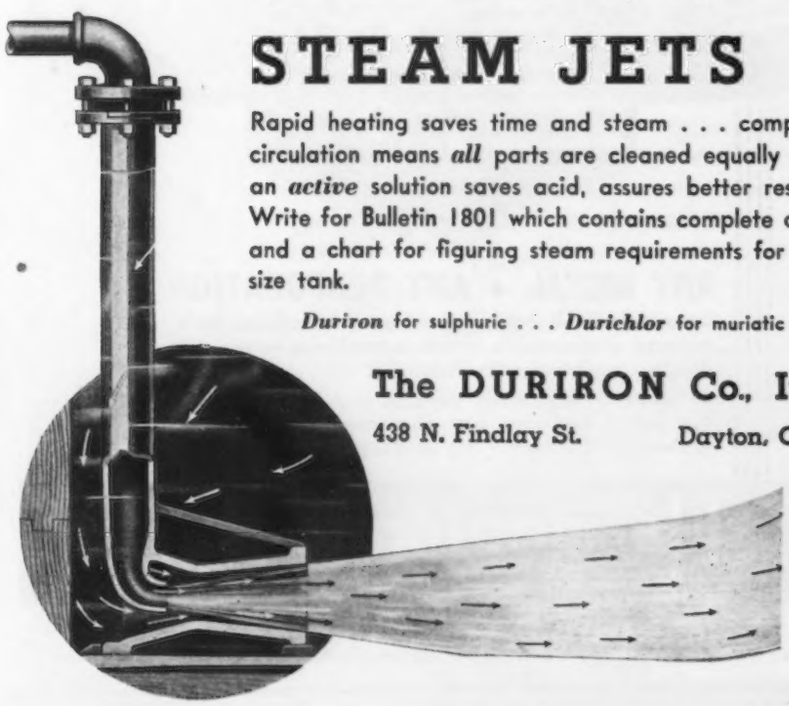
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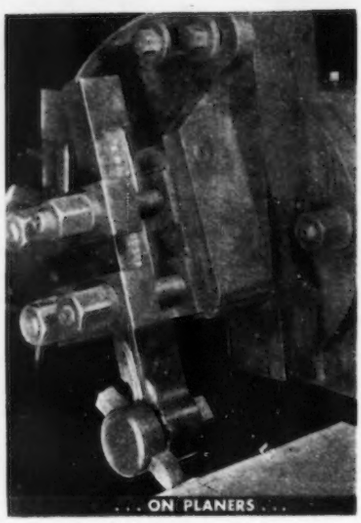
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Tri-State Welding Meeting Draws 300

PITTSBURGH — More than 300 plant executives and engineers last week attended the second annual Tri-State Welding Conference, sponsored by the Pitsburgh section of the American Welding Society and the Engineers' Society of Western Pennsylvania.

R. P. Palmer, welding supervisor, Wheeling Steel Corp., Steubenville, who has had over 20 years experience in job shop and steel mill equipment manufacture, discussed several welding projects done at the Steubenville works and illustrated his talk with slides showing actual application of welding methods. Subjects covered included repairs to agitator pokers used in gas producers; slab baskets used in blooming mills; water-cooled doors for reheating furnaces; and worn roll necks and bearing surfaces. Also, water-cooled soaking pit rails; open-hearth door frames; structural sections for crane runways; dashpots for blast furnace blowing engines; and a new method of welding clam shell buckets to assure precision bite.

Points to Savings

According to Mr. Palmer, the application of maintenance welding in steel mills has in the past few years represented savings of hundreds of thousands of dollars in addition to guaranteeing uninterrupted production. His talk closed with a paper on "Building and Equipping a Plant Weldery."

G. W. Linkhauer, manufacturing engineer, United Engineering & Foundry Co., Pittsburgh, presented an interesting discussion covering welding methods used in fabricating reduction gear drives, roller tables, strip weld machinery, and many other kinds of rolling mill equipment.

The automatic "Unionmelt" process which is being adopted by some shipyards, boat yards, and plate fabricating shops, was described and illustrated with motion pictures by F. G. Outcalt, welding engineer, Unionmelt Division, Linde Air Products Co., New York.

Welded Steel Houses

The Hobart Welded Steel Houses, Inc., began experimenting with welded steel design in 1934, and W. J. Chaffee, territorial director, Hobart Brothers Co., Troy, Ohio, who has been intimately engaged in the production and promotion of steel houses for the past four years, presented a paper on

welded steel houses. His talk dealt with the problems incident to fabrication, transportation to the site, erection, etc. According to Mr. Chaffee, his company believes in the complete fabrication and erection of a house in the factory on a production basis, and has erected a complete factory for that purpose.

Midwest Safety Conference In Chicago May 9-11

CHICAGO—The 17th annual Midwest Safety Conference will be held in Chicago May 9 to 11. The conference is sponsored by the Greater Chicago Safety Council, Association of American Railroads, Safety Section, Illinois Industrial Commission, Institute of Traffic Engineers, Keep Chicago Safe Committee and cooperating agencies. At a banquet to be held May 11 an address on "Safety in Industry Today" will be delivered by C. M. White, vice-president in charge of operations, Republic Steel Corp.

F. H. Clausen Will Give A.F.A. Awards Lecture

FRED H. CLAUSEN, president of Van Brunt Mfg. Co., Horicon, Wis., has been chosen by the American Foundrymen's Association to deliver its annual awards lecture. The address, entitled "Business Management has a Job," will be given at the association's annual business meeting in Cincinnati on May 17, in conjunction with the annual foundry convention.

Mr. Clausen is vice-president of the Chamber of Commerce of the United States, a past president of the Wisconsin Manufacturers' Association, chairman of the board of Holeproof Hosiery Co., a director of Deere & Co., and vice-president of the Farm Equipment Institute.

Gray Iron Founders Will Meet on May 15

THE annual meeting of the Gray Iron Founders' Society will be held at the Netherland-Plaza Hotel in Cincinnati on May 15, according to W. W. Rose, executive vice-president. Foundrymen attending the American Foundrymen's Association convention, which will also be held in Cincinnati in the week of May 15 have been invited to attend the society's meeting.





Open-Hearth Problems Probed

(CONTINUED FROM PAGE 58)

melt down the charge prior to working the heat. The usual duration of the working-down period is about 1½ hr. To insure a fast tap, which is essential to prevent large ladle skulls and pouring difficulties, a 6 in. diameter tap hole is used. This is closed with raw and faced off with double burned dolomite. The surface condition of the ingots from this furnace are in general, with the exception of the 6 x 6 in. size, as good or better than the usual run of production ingots.

Considerable discussion arose over this furnace, and one interesting point brought out by Mr. Banta was the company's intention of using a basic wall and roof on this furnace when it is rebuilt.

Instrumentation

Each year more and more discussion develops on the advisability of instrumentation and the savings in operation that may follow from such practice. Many plants are seeking reliable data along this line, particularly smaller mills, so that management can be convinced that the expenditure for instruments would be justified.

L. R. Berner, of Inland Steel Co., offered some interesting observations on this subject, dealing with full automatic air-fuel ratio control as against semi-automatic air-fuel ratio control. When the new end of Inland's No. 2 shop was built, all nine furnaces were equipped with semi-automatic air-fuel ratio controls. With this semi-automatic control the operator is required to change the air volume flowing each time the oil rate is changed. The amount of change is indicated by a meter.

After two campaigns one of these furnaces was equipped with full automatic control; thus, whenever the operator varies the fuel rate, the rate of air flow is automatically changed to hold the set air-fuel ratio. This setting was made to deliver to the furnace 1450 cu. ft. of air for every gallon of oil used; such a setting gave a gas analysis from the furnace downtakes, during the finishing of a heat, of 14 per cent CO_2 and 2.5 per cent O_2, or approximately 15 per cent excess air.

With the operators running this furnace remaining the same, the comparative performance between third and second campaigns would at least give some indication as to what might be expected from full control, according to Mr. Berner.

Comparing the third campaign using full automatic control, with the second campaign using only semi-automatic control, the following differences in furnace operation were revealed:

There were 10,971 more tons produced from full control, i.e., 66,870 tons against 55,899 tons.

There were 53 more heats from full control, i.e., 432 against 379.

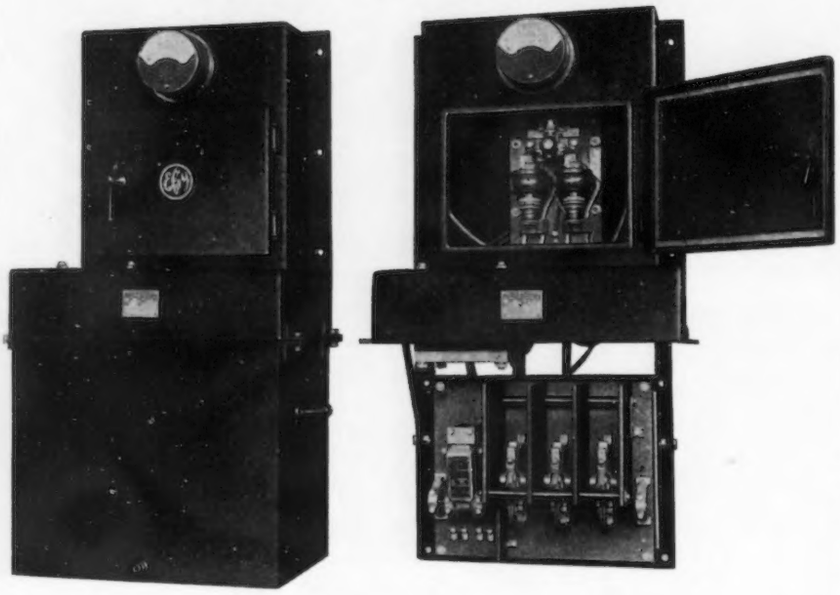
Production per day including all delays was practically the same, i.e., 266 against 267.

Seven tons more per heat were obtained on full control, i.e., 155 against 148.

Two gallons less fuel per ton on full control, i.e., 31.1 gal. against 33.1 gal.

Cost per ton on repair and mainte-

EC&M WALL-MOUNTED STARTER
for 2300 VOLT MOTORS



THIS illustration shows a new, push button operated, wall-mounted EC&M Magnetic Starter for use with a 350 HP, 2300 Volt A.C. Squirrel-Cage Motor. It provides full voltage starting of the motor and is complete with self-contained potential transformer which supplies low voltage for the push button circuit. Self-contained ammeter, mounted above the overload relay door, will record the load on the motor at all times.

Magnetic contactor is of new design and makes and breaks the circuit to the motor under oil. Overload relays protect the motor against overheating due to overloads or loss of one phase. They are of the plunger type with EC&M special drop-back feature which prevents unnecessary tripping on slight overloads.

This wall-mounted enclosure is of NEMA Type 1-A construction. Overload relay door closes against sponge rubber gaskets and oil-tank likewise draws up tightly against similar gaskets. This attractive unit, well suited for steel mills, cement plants, pump houses, oil refineries, etc., is shown on EC&M Photograph 2154. Write today for a copy for your files.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS

nance was 1.3c. less in the case of the "fully controlled" campaign, i.e., 4.7c. as against 6c. per ton

On practically all counts, according to Mr. Berner, the full automatic control looks favorable. On the full automatic furnace, insulation was employed throughout, roof and all. Five Inland furnaces also are equipped with L. & N. roof temperature controls (used as recorders), and Mr. Berner was of the opinion that these instruments are likewise of great usefulness.

In the discussion on the fuel ratio instrumentation, it developed that Inland established the correct ratio by gas analysis in the downtakes; also, the furnace is reversed by temperature rather than by time. As the campaign of the furnace progressed no change was made in the ratio, and the percentage of excess air was maintained throughout despite changes in types of steel in the furnace. Mr. Berner expressed the opinion that this inflexibility had not yet fully demonstrated itself as being most desirable, although for the time being it was judged as being best that operators be given not too much freedom in changing the controls.

Mr. Morrison, of Bethlehem's Sparrows Point plant, stated that after equipping one of their furnaces with fuel control instruments the fuel consumption dropped 3½ gal. per ton, and there was also a noticeable increase in refractory life. Mr. Urquhart, of the Carnegie-Illinois Homestead plant stated that their No. 4 shop was fully equipped with L. & N. pressure controls, and fuel savings of 15 per cent resulted from such control. The shop was also equipped with L. & N. temperature controls, and this resulted in an additional 3 to 5 per cent fuel saving and a 10 to 20 per cent increase in roof life. This company, however, is still having trouble with roof temperature control when firing with coke oven gas.

Bath Pyrometers

The next subject up for discussion dealt with special pyrometers for bath and temperature recordings. M. J. Bradley, of Leeds & Northrup, described a new piece of equipment for measuring open hearth bath temperatures, a general view of which is is shown in Fig. 3. The temperature measurements are made with a Rayotube, which is sighted down a standard 2-in. iron pipe, into the molten metal in the bath. The pipe, which is from 6 to 8 ft. long, depending upon the size of the furnace and the construction of the bath, is protected by an outside pipe, and compressed air is forced down between the two to keep the steel from entering the open end. The pipes are inserted through the wicket in the door and pushed through the slag into the bath from 12 to 18 in. The temperature is measured and recorded in approximately 10 to 20 sec. The pipe shown has been used to make over 100 temperature measurements. The temperature is indicated and recorded on the round chart Micromax potentiometer shown on the truck. The truck is also used to transport the equipment on the open hearth floor.

Dr. Bradley went on to describe the calibration of this instrument, after which an Inland Steel man spoke of a one-month experimental trial of the equipment. Several difficulties were mentioned, such as warping of the tubes, partial clogging of the open end, etc., but it was pointed out that all these difficulties were now under



Finishing "In the Money"

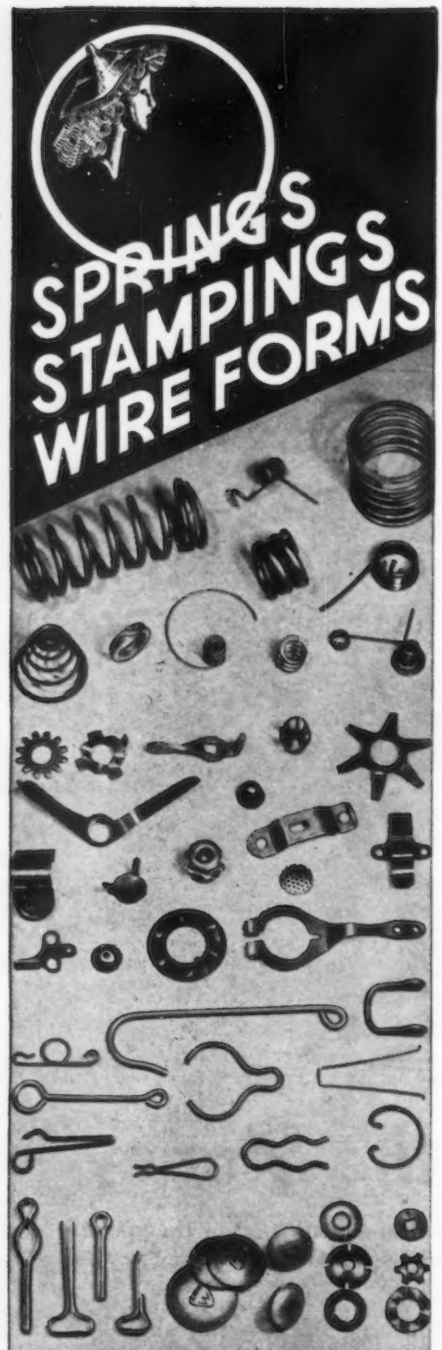
When they're thundering down the stretch, pouring on the speed, it takes every ounce of stamina and experience to finish "in the money."

Today more than ever, the metal finishing track is like the "big track" . . . time allowances are cut to a minimum, costs are figured to a fraction and new finishes crop up like dark horses while you're looking the other way. This puts the metal cleaner on the spot.

For more than a third of a century Wyandotte has been keeping pace with the metal finishing industry. Our Service Representatives are expert trouble shooters. Frequently a call to your Wyandotte Service man can *prevent* trouble from arising.

Equipped with a full line of metal cleaning compounds, and with long years of experience in tackling new problems, your Wyandotte Service Representative is the man to call when things get hot. He is as near as your telephone—call him today!

THE J·B·FORD COMPANY
WYANDOTTE MICHIGAN
DISTRICT OFFICES IN 26 CITIES



It Will Pay You To Inquire

Are you up against a "stickler"—one of those design or production problems that does not quite work out? Hubbard has been solving them for hundreds of customers, with just the right part for the job.

Write us about your problem; send in your drawings or samples. Let us furnish suggestions and quotations.

M·D·HUBBARD SPRING CO.

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investigation and eventual solution was hoped for.

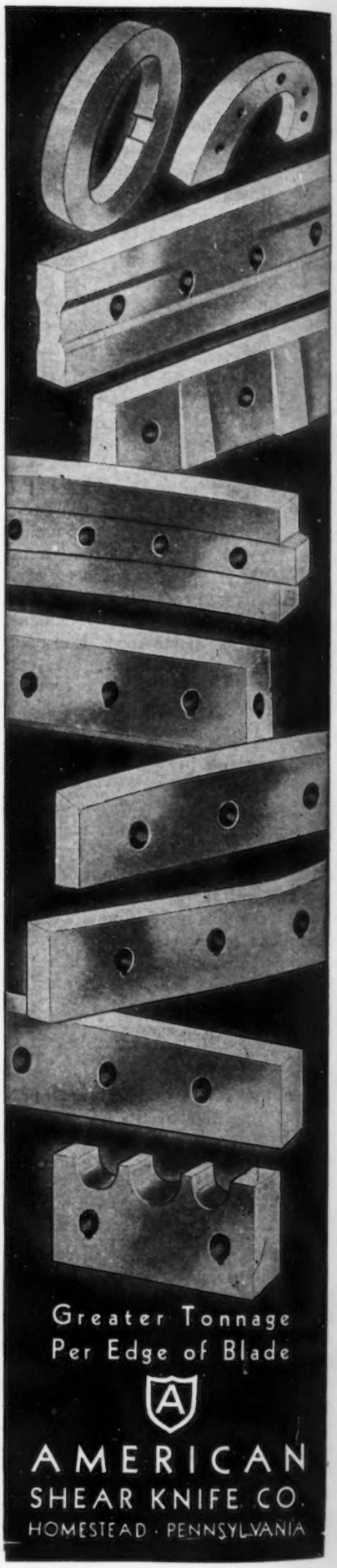
G. R. Fitterer then was called on to describe several improvements made in the design and operation of the carbon-silicon carbide thermocouple. Several recent installations of this equipment were said to have resulted in interesting and informative data, all of considerable accuracy.

Bottom Pouring

The next discussion jumped from thermocouples to the practice of bottom pouring. H. J. Hoffman, assistant open hearth superintendent of Lukens Steel Co., stated that his company bottom pours all ingots in order to get the best surface possible for the direct rolling into a designated patterned plate—this company has no slab mill. Experience showed his company that many problems had to be overcome in order to furnish a given product to suit strict consumer requirements. There being 58 sizes of molds used by the company, the problem of a rate of rise to overcome all obstacles was encountered. This is done by bottom pouring in which it is possible to regulate the number of molds to a group and also the correct nozzle size. This makes it possible to pour several sizes of molds at the same rate of rise (about 10 open, 14 semi-killed, 20 killed) on the same heat. It is necessary to consider the problem of splashing, and this is much easier to overcome in bottom pouring than in top pouring, according to Mr. Hoffman. Lukens strives for the easy or gentle entrance of metal into the mold, and it is a simple matter to use a mat, which in Lukens' practice is ordinary straw, which rises with the metal.

According to Mr. Hoffman this practice entails additional cost, which his company believes is offset by better service, less conditioning of ingots, fewer losses, and the elimination of slabbing and reheating. In making killed steel the company believes that by bottom pouring a great deal of cracking is eliminated, and through so pouring this type of metal it has been possible to reduce the shipping cost to about two-thirds of the previous cost, i.e., which at one time was $1.20 and is now 40c.

Following this discussion of bottom pouring, the meeting adjourned until the afternoon, at which time the metallurgy of killed and rimmed steel was discussed in detail. Details of this interesting afternoon session will be available in the stenographic report of the entire meeting, which will be available in about two months—from the American Institute of Mining and Metallurgical Engineers.



This Week on the Assembly Line

(CONCLUDED FROM PAGE 63)

distributing depot and warehouse. Construction will begin immediately on a 50,000 sq. ft. steel warehouse and a 5000 sq. ft. office building.

Ford Tractor To Go On Mass Production Basis

Henry Ford last week made a further announcement about the new tractor which he intends to produce. Specifically, Mr. Ford said that he was turning the "B" Building at the Rouge plant, which manufactured Eagle boats for the Navy in the World War, into a plant to build the new tractor on a mass production basis. The tractor will weigh 1700 lb. and, according to Ford, will overcome previous difficulties which caused tractors to rear up and overturn. An Irish invention, a hydraulic coupling device, will be used to keep the plow level with heavy load or on uneven ground. No date has been set as yet for the beginning of the tractor manufacture.

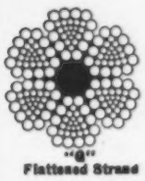
Steel Buying Gains

An increase in steel buying activity has been noted, with some sizable orders believed to have been placed during the past week to take care of late May and June production. Beside this, some smaller fill-in orders have been placed. It is understood that automobile manufacturers are taking every advantage of the quantity deductions which are available under the new set-up. It is difficult, except on larger sheets, to specify 75 tons of one kind of material at one time, particularly when hand-to-mouth buying is so generally practiced. However, in their attempt to do so, automobile manufacturers are watching requirements carefully and placing orders with one vendor only, in many cases. The situation has resulted in tightening up of the amount of information usually available on the subject of steel buying because orders are now restricted to one source of supply rather than being split as has been usual in the past.

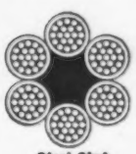
Ore Miners to Choose AFL or CIO Union

BIRMINGHAM—On April 27 a hearing was started in Birmingham by a trial examiner of the National Labor Relations Board to determine whether the International Union of Mine, Mill and Smelter Workers or the American Federation of Labor is entitled to be the sole bargaining agent for the red ore miners of the Woodward Iron Co., Woodward, Ala.


Style B Flattened Strand


"B" Flattened Strand


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There is no guesswork when you use "HERCULES" (Red-Strand) Wire Rope. It is designed and built to do specific jobs better . . . safer . . . more economically. Furnished in a wide variety of constructions so as to be suitable for all purposes—each backed by 81 years of manufacturing experience and close cooperation with users.

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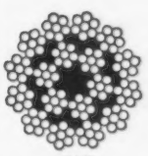
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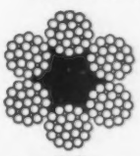
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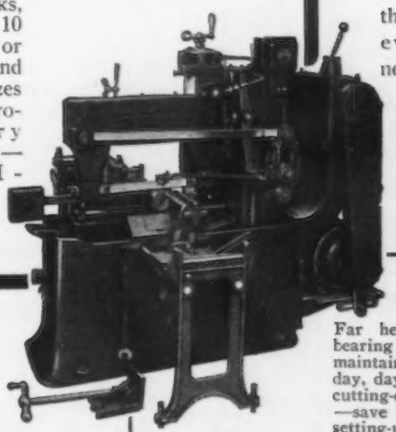

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Automatic Bar Push-Up!

Automatic in fact, requiring no more attention than an automatic screw machine, the new MARVEL 6A and 9A Production Saws will feed to length and cut-off from solid bar steels (to make gear blanks, for example) 10 pieces 6" round or 160 pieces 1½" round (or other bar sizes to 10" x 10" proportionately) every hour floor-to-floor—AUTOMATICALLY!



MARVEL

Automatic Production Hack Sawing Machines (No. 6A and 9A from the MARVEL Line . . . that comprises saws for every metal-cutting need).

Far heavier, with full ball bearing construction, they will maintain this terrific speed all day, day after day. They cut cutting-off costs to a fraction—save stock (chip loss) and setting-up time.

These new, modern, full ball bearing machines are the culmination of over a quarter century of specialization in the building of automatic sawing machines. They are also available in plain models without automatic bar push up.

Buy From Your Local Distributor

Write for Bulletin 600

Armstrong Blum Manufacturing Co.

"The Hack Saw People"

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. . . PERSONALS . . .



C. J. STILWELL

CHARLES J. STILWELL, for the past 10 years vice-president of the Warner & Swasey Co., Cleveland, has been elected president. CLIFFORD S. STILWELL, vice-president, has been elected executive vice-president and L. D. MCDONALD, assistant treasurer, has been made vice-president.

Charles J. Stilwell entered the Warner & Swasey Co. as a machine operator in 1910, following his graduation from Denison University. The following year he was transferred to the sales department, and in 1912 was made district manager of the company's New York office. In 1914 he became European representative for the company and in 1919 was made export sales manager. Three years later he became general sales manager and vice-president in 1929. He served as president of the National Machine Tool Builders Association in 1934.

Clifford S. Stilwell, a graduate of Denison University in 1912, entered the Warner & Swasey Co. in that year as a special apprentice. The following year he was made salesman in the Chicago territory and in 1914 district manager of the Detroit office. He became general sales manager in 1930 and vice-president five years later.

L. D. McDonald joined the company in 1918 and was put in charge of the accounting department four years later. He became credit manager in 1925 and assistant treasurer in 1934.

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CHARLES F. NEWPHER, vice-president and general sales manager of National Screw & Mfg. Co., Cleveland, has been elected president of the American Institute of Bolt, Nut and Rivet Manufacturers, Cleveland.

HARRY O. MCCULLY, general manager of sales, Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., has been elected vice-president. HERMAN H. LIND continues as executive vice-president, and JAMES D. EGGERS as secretary and treasurer.

The annual meeting was held April 25 at the William Penn Hotel, Pittsburgh. Principal address was by DR L. W. BASS, assistant director, Mellon Institute of Industrial Research.

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MARVIN W. SMITH, manager of engineering, Westinghouse Electric & Mfg. Co., East Pittsburgh, has been elected vice-president. He has been associated with Westinghouse since 1915, when he was graduated in electrical engineering from Texas Agricultural and Mechanical College. He was assigned to the power engineering department in 1917, becoming section engineer in 1927 and division engineer in 1930, which position he held until 1936, when he was appointed manager of engineering.

JOHN R. READ has been elected president of the Canadian Westinghouse Co., succeeding PAUL J. MYLER, who had been chairman of the board and president and who continues as chairman. N. S. BRADEN, formerly vice-president of the Canadian company, has been elected vice-chairman of the board.

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A. L. RIEMER was recently elected president and treasurer of the Wisconsin Bridge & Iron Co., Milwaukee, to succeed HERMAN A. WAGNER, who retired from active duty but remains a director of the company. Mr. Riemer started with the company as an office boy in 1910 and has served as a director since 1926 and was vice-president from 1934 until his recent promotion.

J. A. SCHOENECKER, a director since 1936 and secretary of the company since 1934, was elected vice-president to succeed Mr. Riemer. Mr. Schoenecker started as an office boy in 1913. A. B. WALLING, contracting engineer in charge of the Chicago office, was elected vice-president, succeeding E. D. CODDINGTON, who retired in March of this year. Mr. Walling has been associated with the company since 1910 and started as a draftsman. E. F. BARKOW, who started as blueprint boy in 1901 and whose principal interests have been in the engineering and sales departments up to 1935, when he assumed complete charge of the drafting room and plant operations, has been elected secretary.

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HENRY J. MOKATE, associated with subsidiary companies of the United States Steel Corp. since 1920 and manager of the secondary products division since its formation in June, 1938, has been made manager of the new merchant products bureau, sheet division, of the Carnegie-Illinois Steel Corp. CHARLES SCHRAMM succeeds him as manager of the secondary products division. Mr. Schramm has been identified with the United States Steel Corp. at New York since 1902. He has held various sales positions with the former American Sheet & Tin Plate Co. and has been in the sales department at New York office of Carnegie-Illinois since 1936. The merchant products bureau, a newly-created unit of the general sales department, will handle sheet sales to the jobbing trade and certain accounts for galvanized materials.

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GARRETT A. CONNORS has been elected vice-president in charge of industrial relations, Pittsburgh Steel Co. He continues in a similar capacity for the Sharon Steel Corp., Sharon, Pa.

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COL. FRANK A. SCOTT, of Cleveland, has been elected a member of the executive committee of Youngstown Sheet & Tube Co., Youngstown, to serve during the illness of HENRY G. DALTON, also of Cleveland, chairman of the board.

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W. E. BITTNER, of the Diamond Alkali Co., was elected president of the Purchasing Agents Association of Pittsburgh at its annual meeting held recently in Pittsburgh. Other officers elected are: L. M. POTTER of the Vanadium-Alloys Steel Co., vice-president; E. C. BUERKLE, National Bearing Metals Corp., treasurer; C. H.



C. S. STILWELL



L. D. McDONALD



C. F. NEWPHER

RINDFUSS, Pittsburgh Screw & Bolt Corp., secretary; and J. M. KNOWLES, Consolidation Coal Co., Inc., national director.

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C. F. GOLDCAMP has been made assistant manager of sales, cold finished department, Jones & Laughlin Steel Corp., Pittsburgh, and has carried on the work incident to this position for the past several months. Mr. Goldcamp joined Jones & Laughlin in 1923 in the metallurgical department and subsequently became assistant chief inspector, South Side works, chief inspector, Soho works, and in 1930 joined the force of contact metallurgists. In 1935 he was transferred to the cold finished sales department. L. T. WILLISON, who for some time has been a contact metallurgist, has been transferred to the cold finished sales department.

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WALTER B. DODGE, formerly general sales manager of the Stamford division of the Yale & Towne Mfg. Co., New York, has been appointed director of hardware sales, coordinating sales of the Stamford division, the Sager and Barrows division at North Chicago, the Norton Door Closer Co. division, Chicago, and the Canadian division at St. Catharines, Ont.

RICHARD G. PLUMLEY, who has been works manager of the Stamford division for the past four years, has been appointed general manager of that division, and MARK A. MILLER, formerly connected with the sales and executive departments, becomes assistant general manager at Stamford.

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MILTON TIBBETTS, vice-president of Packard Motor Car Co., has been appointed a member of the National Association of Manufacturers committee on patents and trademarks.

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COL. W. R. DUNLAP, special public relations representative, Carnegie-Illinois Steel Corp., Pittsburgh, last week was promoted to Brigadier General in command of the Fifty-third Field Artillery Brigade, Pennsylvania National Guard.

Brigadier General Dunlap formerly commanded the One Hundred Seventy-sixth Field Artillery, the Duquesne Grays, since it was organized in 1920. His military service began in 1903 and he holds a distinguished service medal from the War Department.

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H. E. LEWIS, board chairman and president, Jones & Laughlin Steel Corp., Pittsburgh, has been appointed a member of the National Association of Manufacturers' committee on industrial practices.

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JOHN STORM, who has been a member of the Detroit sales staff of the Carborundum Co., Niagara Falls, N. Y., has been appointed district sales manager at New York. He succeeds FRANK J. HARRINGTON, who has been transferred to the main office sales department.

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OWEN HOLLENBAUGH has been made blast furnace superintendent of the Alan Wood Steel Co., Conshohocken, Pa., succeeding C. E. AGNEW, who has resigned.

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ALFRED MARCHEV, works manager and chief engineer of the Signode Steel Strapping Co., Chicago, has been elected to the board of directors, succeeding H. C. PORTER, who has resigned.

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DR. H. JERMAIN CREIGHTON, head of the chemistry department at Swarthmore College, since 1928, has been elected president of the Electrochemical Society.

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J. E. FREEMANN, who has been engaged in the sale of material handling equipment in the Philadelphia territory for 20 years, has been made district manager of the Baker Industrial Truck Division of the Baker-Raulang Co., Cleveland. He will be assisted by EMORY N. MUMMA. The Materials Handling Co., 709 Arch Street, Philadelphia, will handle the district sales representation.

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O. R. HARPOLE has been named district salesman in St. Louis for U. S.

L. Battery Corp. of Niagara Falls, N. Y., and JOSEPH SABOURIN, JR., has been named to the Kansas City district. Mr. Harpole previously was with Milton Oil Co. in the St. Louis district and Mr. Sabourin was with the Prestone division of the National Carbon Co. in the Kansas City area.

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HERBERT ROOS is now factory representative for the Whitney Metal Tool Co., of Rockford, Ill., in the New York metropolitan area. His address is at the Parkside, 18 Gramercy Park South, New York. He is cooperating with dealers in the district.

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PAUL C. NICHOLSON, for the past 26 years vice-president of the Nicholson File Co., Providence, has been elected president and general manager of the company, succeeding his father, the late Col. S. M. Nicholson. Paul C. Nicholson became identified with the company shortly after his graduation from Yale University in 1911. He went through the various departments to learn the business thoroughly and was elected vice-president in 1913 and treasurer two years later.

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DR. FRANCIS C. FRARY, director of the research laboratory of the Aluminum Co. of America, Pittsburgh, has been awarded the Edward Goodrich Acheson medal of the Electrochemical Society. Dr. Frary is a past-president of the society and has contributed a number of important papers on the electrometallurgy of aluminum.

❖ ❖ ❖

HAMILTON B. BOLE, formerly president of the Barst Forster Dixfield Co., New York, has been placed in charge of the newly-opened Eastern office in the Graybar Building, New York, of the Trundle Engineering Co., Cleveland.

❖ ❖ ❖

C. M. HUGHES, formerly of Zapon, Inc., has been placed in charge of the lacquer department of the Hilo Varnish Corp., Brooklyn, N. Y.

❖ ❖ ❖

ELLIS GEORGE MALPAS, who for nearly 20 years has been factory manager for the Sealed Power Corp., Muskegon, Mich., resigned recently to engage in the citrus fruit growing business at Rockledge, Fla.

. . . OBITUARY . . .

ALBERT G. DAVIS, formerly vice-president in charge of patents, General Electric Co., Schenectady, N. Y., died of pneumonia at his home in New York on April 25, aged 67 years. He retired in 1933 after having been identified with the General Electric Co. for 35 years. He was graduated from Massachusetts Institute of Technology in 1893 and for a time after that was engaged as a patent attorney in Washington.

❖ ❖ ❖

JULIUS ROESCH, JR., president, Steel Sales Corp., Chicago, died April 27 at the Duquesne Club, Pittsburgh. Mr. Roesch was also a director of the Copperweld Steel Corp., Pittsburgh. He was 58 years old.

❖ ❖ ❖

FRANK D. REED, vice-president and purchasing agent of the Rock Island Railroad, died last week in Chicago after an illness of several months, aged 71 years. Mr. Reed, after a Chicago public school education, entered railroad service in 1884 in the Chicago shops of the Pennsylvania. In 1904 he went to the Rock Island lines as chief motive power clerk.

❖ ❖ ❖

WILLIAM E. RICHARDSON, president and founder of the Richardson Machine Co., Birmingham, died April 23, from a heart attack. He had operated the machine company for more than a quarter of a century.

❖ ❖ ❖

WILLIAM H. JACKSON, aged 71, president, Pittsburgh - Des Moines Steel Co., Pittsburgh, died April 26 in Pittsburgh. He had been president of the Pittsburgh-Des Moines Steel Co. for the past 17 years.

❖ ❖ ❖

PETER DEVRIES for the last 22 years associated with Walter D. McKenzie in the Trio Tool Co., was buried Saturday, April 29, at Detroit. Mr. Devries, who was 59 years old, was born in The Netherlands and had been a resident of Detroit for more than 50 years. For more than 30 years he was engaged in the tool manufacturing business.

❖ ❖ ❖

ALBERT I. CARNEY, who for the last 12 years had been president of the Rim & Wheel Service Co. in Detroit, was buried April 25. Mr. Carney, who was 53 years old, was a director of the National Wheel & Rim Association, an organization which establishes standards for automotive requirements.

❖ ❖ ❖

J. WILFRED WATSON, 60 years old, Canadian representative of No-Sag Spring Corp., died April 25 at Toronto. He was born near Durham, Ont., and had lived in Toronto for the past 10 years but had been a resident of Detroit and Highland Park for 30 years. Formerly he was with the sales department of General Motors Truck Co. and Federal Motor Truck Co. in Detroit and Toronto.

❖ ❖ ❖

J. RENWICK WILKES, for the past 46 years identified as a partner in the Mecklenburg Iron Works, Charlotte, N. C., died in that city after a long illness on April 19, aged 67 years. He was graduated from Stevens Institute of Technology in 1893.

❖ ❖ ❖

ELY JOSEPH CONTOIS, 51 years old, Chicago district sales manager for the Clark Equipment Co., was buried Monday, April 24 at Battle Creek, Mich. He was a member of General John Pershing's headquarters staff during the World War.

❖ ❖ ❖

ROBERT M. REPP, SR., president, Logan Gregg Hardware Co., Pittsburgh, died April 25 in Pittsburgh. Mr. Repp was 74 and had been associated with the firm 58 years, having been president 13 years.

❖ ❖ ❖

JAMES W. REYNOLDS, engineer for the Hancock Mfg. Co., Jackson, Mich., died March 29, aged 61 years.

❖ ❖ ❖

CHARLES BENJAMIN COATES, electrical engineer for the Chicago Pneumatic Tool Co., Cleveland, died on March 17, aged 69 years. He had been identified with the company since 1908 and was a prominent figure in the development of portable electric tools. He was a graduate of Cornell University.

❖ ❖ ❖

SAMUEL R. COHEN, vice-president of Maremont Automotive Products, Inc., Chicago, died at the Michael Reese Hospital in that city on April 12.

MISS MAY E. HYDE, treasurer and a charter member of the Steel Supply Co., Chicago, died last week in Chicago after a long illness. Miss Hyde had been identified with the distribution of steel in various capacities for many years.

Bethlehem Unfilled Orders At New Peace-Time Record

NET profit of Bethlehem Steel Corp. in the first quarter was $2,409,059 with ingot output averaging 53.8 per cent of capacity, as compared with $3,658,160 at 56.5 per cent in the preceding quarter and $994,908 at 34.6 per cent in the first quarter of 1938. The March quarter income was equal, after preferred stock dividend requirements, to 17c. a common share. The regular quarterly dividends on both classes of preferred stock were declared.

Unfilled orders on hand March 31 totaled $192,040,906, the highest peace time figure in the corporation's history, but included a large volume of shipbuilding contracts. At the end of the previous quarter the backlog was $162,774,713, and at the close of the first three months of 1938 was $99,934,192.

Current ingot operations are at 59 per cent of capacity, the highest rate reached thus far this year. In March the rate was 56.6, in February 53.7 per cent, and in January was 51.2 per cent. Incoming business in April was substantially below raw steel production, Eugene G. Grace, president, said, the volume being equal to about 49 per cent of capacity. During most of the quarter, Mr. Grace stated, bookings were in excess of output, but the situation is now reversed, and ingot operations are not being supported by new business. He felt that there was nothing in the immediate picture to suggest any important gain in operations. If there is a change, he looks for it to be on the downward side.

Higher Prices Necessary

Commenting on the price situation, the steel executive credited the rise in the "break-even" point to the generally lower billing prices prevailing in the quarter. Production costs, he stated, were firmly fixed, and inferred that higher selling prices were necessary if the corporation was to realize a "just" return on its invested capital.

Questioned as to foreign purchases of steel, Mr. Grace said that he knew of no large tonnage having been bought recently, although he was aware of an inquiry for 100,000 tons of sheets from England. He did not believe that this material had been placed yet.

The use of steel in housing is gradually increasing, he stated, not as much from the prefabricated house angle, as from its use as structural members. He credited large-scale housing projects, such as the Metropolitan Life Insurance development in New York, as becoming increasingly important consumers of steel products.

Average number of workers employed in the first quarter was 88,000 against 86,350 in the fourth period of 1938 and 84,400 in the first quarter of 1938. These employees worked an average of 33.4 hr. per week at an average wage 87.4c. per hr. in the March quarter, 32.5 hr. at 88.2c. per hr. in the last quarter of 1938, and 28.5 hr. at 85.9c. per hr. in the March quarter a year ago.

Among steel and allied companies reporting net profits for the first three months of 1939 are:

	1st quarter 1939	1st quarter 1938
National Steel Corp.	$2,426,668	$1,088,635
Republic Steel Corp.	532,899	*3,062,564
Inland Steel Co.	2,024,601	923,076
Sharon Steel Corp.	7,613	*151,909
Truscon Steel Co.	20,418	*305,144
Keystone Steel & Wire Co.	317,608	198,569
American Rolling Mill Co.	793,479	*197,310
Wheeling Steel Corp.	828,661	*531,035
Pittsburgh Screw & Bolt	*8,126	97,255
Pittsburgh Coke & Iron Co.	94,026	77,689
A. M. Byers Co.	122,998	*209,681
Acme Steel Co.	399,672	969

*Loss.

South Africa Plans New Steel Works

LONDON—South Africa is to have a second steel works, comparing in size and equipment with anything at present existing. The establishment of the new works was foreshadowed at the end of March by Dr. H. J. van der Byl, chairman of the Electricity Supply Commission and of the Iron and Steel Corporation, Pretoria, when he turned the first sod of the new Vaal Power Station, near Vereeniging. This station, with the Vereeniging and Klip station, will form one of the most up-to-date electric supplies in the world.

The new steel plant will be at Vereeniging and will be driven entirely by electricity. The plans for the new industry are complete and as soon as the international situation is more promising the plant will be ordered, declared Dr. van der Byl.

National Steel to Save $525,000 on New Bonds

PITTSBURGH — The $65,000,000 of National Steel Corp.'s bonds and serial notes offered recently are for the purpose of refunding existing obligations and the interest obligation will be greatly reduced, according to E. T. Weir, board chairman. During the first year alone, he said, the interest on the new bonds and notes will be approximately $525,000 less than the interest on the items replaced.

The present refunding is the third instance in the corporation's history where savings have been effected by refinancing obligations at lower interest rates.

Structural Shipments Highest in 16 Months

SHIPMENTS of fabricated structural steel in March were 122,918 tons, an increase of 47 per cent over the February total of 83,546 tons and the highest monthly figure since November, 1937, according to American Institute of Steel Construction. In March a year ago shipments were 103,300 tons. The accumulative total for the first three months of the present year is 288,647 tons, as compared with 272,224 tons in the corresponding period of 1938.

New orders booked in March were 89,530 tons, a 10 per cent gain over the February total of 81,298 tons and comparing with 84,257 tons in March, 1938. New bookings in the first quarter amounted to 272,160 tons against 221,721 in the like period of 1938.

Comparative Earnings of Bethlehem Steel Corp.

	First Quarter 1939	Fourth Quarter 1938	Third Quarter 1938	Second Quarter 1938	First Quarter 1938
Net Income	$2,409,059	$3,658,160	$446,866	$150,305	$994,908
Rate of ingot output	53.8%	56.5%	46.4%	35.7%	34.6%

Westinghouse Air Brake Co., Wilmerding, Pa., reports earnings of $399,015, equal to 12c. a share, for the first quarter of 1939, compared with $135,030 in the corresponding 1938 period, George A. Blackmore, president, told stockholders that he expected a similar volume of business in the second quarter of this year.

. . . THE NEWS IN BRIEF . . .

Auto production passes spring peak . . . May estimated at 330,000 units . . . Crosley midget car a "stripped" job with little interior trim . . . Chrysler announces modernization of Los Angeles plant . . . Henry Ford says tractor manufacturing will begin at Rouge plant.—**Page 60.**

Leiserson appointment to NLRB may not check fight for Wagner Act amendment.—**Page 64.**

Monopoly Committee is unlikely to hear steel industry's side before fall.—**Page 66.**

Grinding wheel recommendations are revised by U. S. Bureau of Standards.—**Page 67.**

Germany's 1938 magnesium output rises above 12,000 metric tons (world output for 1937 was 10,000 tons).—**Page 68.**

Navy Department leases part of South Charleston, W. Va., ordnance plant to Carnegie-Illinois Steel Corp.—**Page 68.**

Wagner measure would authorize national housing census every five years.—**Page 68.**

Sharply expanded lead production is forecast for Austria following seizure by Reich.—**Page 68.**

F. L. Llewellyn, U. S. Steel Corp. research engineer, honored for steel welding research.—**Page 70.**

Bureau of Public Roads opposes superhighways across U. S.—**Page 70.**

President Roosevelt proposes plan for merging Government bureaus into three central agencies.—**Page 71.**

Germany's metal-working machinery exports to South America double exports of U. S.—**Page 72.**

NLRB dissolves another non-CIO union; rules against Metal Door & Trim Co.—**Page 72.**

Government iron and steel awards for latest reported week total $510,973.—**Page 73.**

House approves $100,000,000 expenditure for manganese, tin, chromium, other war-time materials.—**Page 73.**

Golf clubs took 534 tons of steel in 1939.—**Page 74.**

Allis-Chalmers Mfg. Co. will build new transformer plant at Pittsburgh.—**Page 74.**

First quarter consumption of iron and steel scrap 7,158,465 tons.—**Page 74.**

Steel industry's aggregate loss last year $14,879,000 against profit of $228,276,000 in 1937.—**Page 75.**

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MEETINGS

May 15—Gray Iron Founders' Society, Cincinnati.

May 15 to 18—American Foundrymen's Association, Cincinnati.

May 16 and 17—American Steel Warehouse Association, Chicago.

May 22 to June 8—Society of Automotive Engineers, world congress, in various cities.

May 24 and 25—National Metal Trades Association, Chicago.

May 25—American Iron and Steel Institute, New York.

May 25 to June 1—Triple Convention (American Supply and Machinery Association, the National Supply and Machinery Distributers' Association and the Southern Supply and Machinery Distributers' Association), on board the S.S. Monarch of Bermuda.

June 5 and 6—Associated Machine Tool Dealers, Schenectady.

June 26 to 30—42nd annual meeting of American Society for Testing Materials, Atlantic City.

Scottish companies agree on merger.—**Page 75.**

Tri-State welding conference draws 300; welding in steel plants discussed.—**Page 76.**

C. M. White, Republic Steel Corp. vice-president, will address 17th Annual Midwest Safety Conference in Chicago, May 9-11.—**Page 77.**

F. H. Clausen will give **A.F.A.** annual awards lecture May 17.—**Page 77.**

Gray Iron Founders will meet May 15 at Cincinnati.—**Page 77.**

Woodward, Ala., red ore miners to choose between AFL, CIO unions.—**Page 81.**

National Steel to save $525,000 yearly by bond refunding.—**Page 81D.**

South Africa plans new steel works.—**Page 81D.**

Bethlehem Steel Corp. earns $2,409,059 in first quarter; current operations 59 per cent.—**Page 81D.**

March structural steel shipments were highest in 16 months.—**Page 81D.**

Meehanite Metal Corp., Pittsburgh, forms South African subsidiary.—**Page 84.**

Kaiser Wilhelm 1938 bulletins available.—**Page 84.**

British iron mines in Spain released.—**Page 85.**

Welsh tin plate companies merge.—**Page 85.**

Imports of iron and steel products by the U. S. increase 10 per cent in first quarter.—**Page 91.**

American Society of Metals publishes 636-page book on forging.

Engineer's importance to industry grows, T. M. Girdler tells Case School men.

Aetna Standard Engineering executive traces seamless tube history; A.I.S.E. members visit Sheet & Tube mills.

"Key To Recovery" is United States Chamber of Commerce theme; Roosevelt rejects bid to speak.

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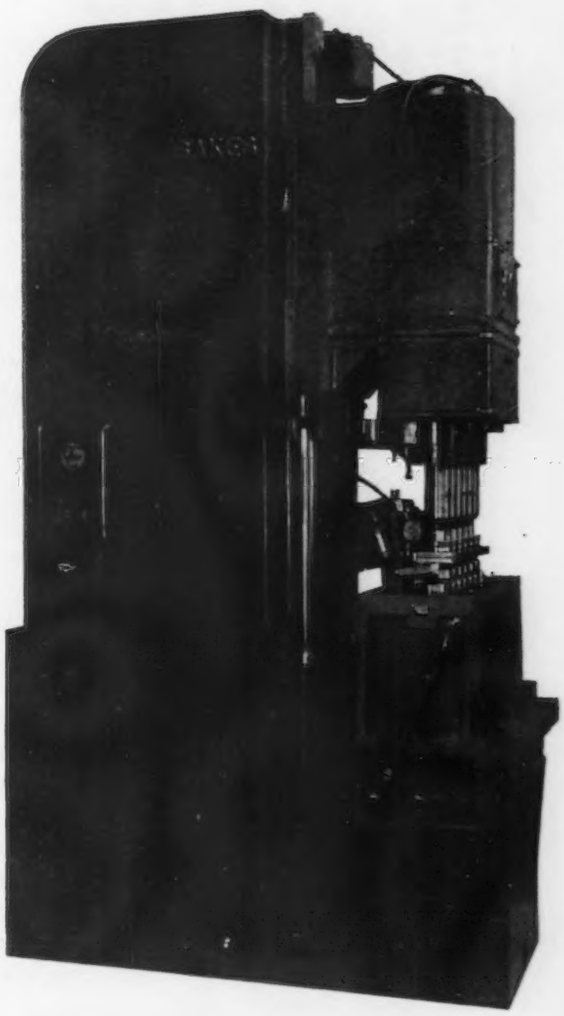
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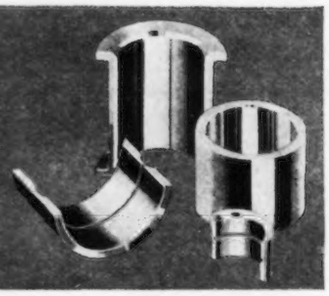
20-HO vertical hydraulic machine with two auxiliary units for chamfering top and bottom of cylinder bores, drilling small hole from distributor bore to crank case chamber, drilling one small hole from front end into cam bore, and machining clearance at lower end of bore for a depth of 7/8".

★BAKER★

Meehanite Forms Branch Company in South Africa

PITTSBURGH—In order to grant manufacturing rights for Meehanite Metal to South African concerns and because of increased industrial activity in South Africa, accompanied by considerable expansion among iron and steel producers, the Meehanite Metal Corp., Pittsburgh, has established a subsidiary company known as the South African Meehanite Metal Co. (Pty.) Ltd., Johannesburg, South Africa. Meehanite manufacturing processes have already been installed in two companies in the Transvaal: The East Rand Engineering Co., Ltd., and the Wright-Boag & Co., Ltd.

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Kaiser Wilhelm 1938 Bulletins Available

BULLETINS of the German Institute as usual contain a wealth of information, according to a report furnished by W. Trinks, of the Carnegie Institute of Technology. In 1938, the bulk of the subjects investigated was metallurgical, both on the physical and on the chemical side. The mechanical side was less emphasized than in other years. Lack of space forbids a detailed review of these bulletins. Each one represents work done with German thoroughness. The bulletins can be purchased singly either from the Kaiser Wilhelm Institute für Eisenforschung, Duesseldorf, Germany, or from G. E. Stechert & Co., 33 East Tenth Street, New York.

Volume 20

(1) Fatigue testing of steel wires with varying tensile stress (II Effect of variations in drawing upon tensile strength under fluctuating stress). 2.70 Marks.

(2) Alternating stress and state of crystallization. 3.75 M.

(3) Use of potentiometric analysis in the chemical laboratory of a steel plant VIII. (A simplified determination of manganese, chromium, and vanadium, simultaneously). 1.25 M.

(4) Cold-rolling tests with steel which has been plated with nickel, copper, or brass. 1.80 M.

(5) On the influence of rate of cooling on the transformation of steels (II A recording electric dilation meter, and the influence of slow cooling upon the transformation temperature of carbon steels; III same for a photoelectric instrument). 2.25 M.

(6) How to save manganese in the open-hearth process. 2.00 M.

(7) The weld-brittleness of chromium-molybdenum steels; and on welding rods for acetylene welding, considering weld-brittleness. 2.75 M.

(8) On magnetic testing of materials. 2.25 M.

(9) Comparative investigation on hardness penetration of chromium-molybdenum steels. 4.25 M.

(10) Austenite transformation in the undercooled state of iron-nickel-carbon alloys. 2.00 M.

(11) Grain structure and strength of high-grade cast iron. 3.50 M.

(12) The system iron-rhenium. 1.25 M.

(13) The influence of electrode di-

ameter (test conditions) upon the mean error in spectral analysis. 3.00 M.

(14) Spreading in rolling high-carbon flat wire from round rods; initial diameters in rolling flat wire from round rods. 6.50 M.

(15) The diagram iron-niobium; and the iron corner in the iron-niobium diagram below 1050 deg. C. 3.25 M.

(16) Effect of rate of cooling upon the transformations and properties of vanadium steels. 3.00 M.

(17) Alternating stress and state of crystallization (II Crystal deformation in fatigue). 2.00 M.

(18) A magnetic scale for measuring saturation. Saturation of cementite and carbon steels as a function of temperature and previous history. 1.60 M.

(19) Evaluation of time-stretch curves by different methods for determining fatigue-strength. 3.25 M.

(20) Work requirements and flow of material in die forging. 5.00 M.

Rail Production 622,895 Tons in '38

PRODUCTION of rails in the United States during 1938 totaled 622,895 gross tons, compared with 1,445,739 tons in 1937, and 2,722,138 tons in 1929, the American Iron and Steel Institute reports. Of last year's total, 602,981 tons were open hearth, 55 tons bessemer and 44,283 tons "all other." Thirteen works, of which three are in Pennsylvania and three in Alabama, were rolling rails from ingots in 1938. Rails made in Pennsylvania alone totaled 182,534 tons and of the rails produced in all states last year 331,727 tons were between 100 and 120 lb. per yd. and 167,887 tons between 120 and 136 lb.

British Iron Mines In Spain Released

LONDON—British iron mines in Spain are gradually starting work again under peace-time conditions. Sir Andrew Lewis, chairman of Millom & Askam Hematite Iron Co., has been informed that the company's mine at Alquife has now been released by the Franco forces. Application has therefore been made to the Franco Government for permission to allow the British staff to return. This company owns the Alquife Mines & Railway Co., which owns important iron ore mines in Spain. It is understood that the plant and mines are undamaged.

Welsh Tin Plate Companies Merge

LONDON—The amalgamation of five Welsh tin plate companies, just completed at Llanelly, is likely to lead to the formation of the third largest concern in the South Wales tin plate trade. The name of the new concern is Llanelly Associated Tinplate Companies, Ltd. With head offices at Llanelly it embraces the interests of five companies—Old Castle Iron & Tinplate (Llanelly), Western Tinplate (Llanelly), Ashburnham Tinplate (Burry Port), Kidwelly Tinplate (Kidwelly), and Teilo Tinplate (Pontardulais). Between them these concerns employ 3000 men.

Sir Evan Williams, chairman of the Coal Owners' Association of Great Britain, is chairman of the new combine.



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Ohlson Traces Seamless Tube History; A.I.S.E. Visits S-T Mills

YOUNGSTOWN—More than 500 steel executives and engineers this week inspected Youngstown Sheet & Tube Co.'s new seamless tube mill. After visiting the Brier Hill plant where tube rounds are manufactured, the group of officials saw actual operation of the new tube mills at the Campbell works and attended a dinner and technical session, during a national meeting of the Association of Iron and Steel Engineers sponsored by the Pittsburgh and Youngstown district sections.

At the technical session in the evening, Carl Ohlson, vice-president, Aetna Standard Engineering Co., reviewed developments in seamless tube manufacture. Mr. Ohlson said that beginning with 1885, the manufacture of seamless tubes received its real impetus by the Mannesmann brothers' invention of the most widely used method of producing tubes, by piercing a solid round between oblique rolls. He related interesting circumstances and incidents leading up to this invention and traced seamless tube manufacturing history from that point on. The new Youngstown Sheet & Tube mills, he said, represent the latest and most powerful installation of its kind in the United States.

According to Mr. Ohlson, although much progress in the manufacture of seamless tubing has been made in the past 40 years, there still remain many improvements to be made in order to meet the more severe specifications, particularly with respect to dimensional tolerance, which are likely to appear. He felt confident that this difficult problem would be solved.

S. M. Weckstein, chief engineer, Timken Roller Bearing Co., presented a paper on "Application of Anti-Friction Bearings to Tube Mill Equipment." Mr. Weckstein's talk covered various applications including those on the mill inspected earlier in the day.



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Arnold Outlines Administration's Anti-Trust Policy

WASHINGTON — Thurman W. Arnold, Assistant Attorney General of the United States, said here Monday that the Sherman Act can be classified only by application to particular industries. His remarks, accepted as the first clear outline of the administration anti-trust policy, were addressed to the spring meeting of the American Trade Association Executives.

Mr. Arnold, in charge of the Department of Justice's anti-trust division, said that the Sherman law requires a referee with power to exercise judgment.

"Wise business leadership," he said, "should be willing to accept an independent judiciary as such a referee to preserve competition rather than to drift into combinations which in the long run can only end in positive government control of a regimented industrial economy."

Mr. Arnold set forth the following

three specific principles in the application of the law, required, he said, by the economic necessities of the machine age:

1. Combinations which actually contribute to the efficiency of mass production should not be destroyed.

2. Concerted action on the part of groups of competitors in order to insure orderly marketing conditions should not be considered unreasonable.

3. The third situation to which the rule of reason must be applied has been created by our lack of enforcement in the past. A short phrase to describe it would be to call it the problem of unscrambling the eggs. Where competition has been destroyed mere imposition of penalties does not re-create it. Economic dislocation in great industries must be avoided.

Advocates Consent Decree

The Assistant Attorney General said that an important part of the anti-trust division's task is to facilitate compliance with the law by helping conscientious business men to understand these principles. The division, he pointed out, has no right to direct business as to what practices it must adopt. There is, however, Mr. Arnold declared, a pressing need of precedents to inform particular industries as to what they may do.

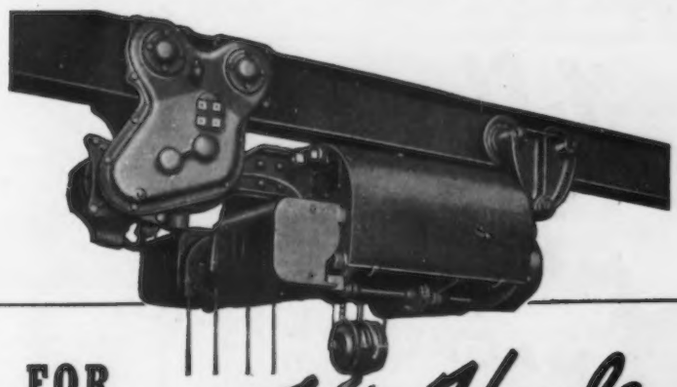
"The use of the consent decree for this purpose," he said, "may be illustrated, as follows: suppose that the Anti-trust Division brings a proceeding to prevent certain existing practices which are contrary to law. If the situation is one in which pure competition is a sufficient solution the mere imposition of penalties will solve the problem. If, however, the problem is complicated by the necessity of some sort of combination or concerted action, business men are compelled by necessity to substitute new practices to fill the vacuum created by the abandonment of the old. It is absurd to withhold this information from business men as to whether the substituted practices will be approved. In such a case the department will submit to the court any plan voluntarily offered by defendants in an anti-trust proceeding which furthers efficiency or orderly marketing conditions, or which may be necessary to avoid extreme economic dislocation, to obtain a decision on its legality. It will not suggest such a plan. It will not give advisory opinions to business. Consent decrees are only a means of terminating a litigated proceeding in an economic way. As such they may form precedents persuasive in similar cases. This much of a guide to business is an essential to any enforcement program."

Trade Notes

The Uddeholm Co. of America, Inc., 4532 West Palmer Street, Chicago, has appointed the Peninsular Steel Co., of Cleveland, Detroit, Dayton, Grand Rapids and Toledo, as distributor of Uddeholm tool steels in Illinois.

The Borg-Warner Corp., Chicago, has acquired the Pump Engineering Service Corp., Cleveland, a leading maker of airplane parts. The Cleveland company will be operated as a subsidiary with the present management continuing as heads of the business. William S. Jack, one of the founders, will remain president.

L. A. Young Spring & Wire Corp. and subsidiaries reported net profit in March of $109,355 against a net loss of $246,270 for the corresponding 1938 period. The company stated that the Chicago and Detroit manufacturing divisions had first quarter gross sales 62 per cent ahead of the comparable period last year, while consolidated gross sales of the company were about 40 per cent ahead of 1938.



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The *motor trolley type* A-E-CO Lo-Hed Hoist should be used—It is driven by a separate motor and controlled from the floor.

For high-lights of this hoist see A-E-CO POINTS (below). For full details of Lo-Hed hoists, send for our new catalog today.

A-E-CO POINTS

- Available in capacities from ½ to 6 tons.
- Operates on Standard I-beam or track of any make.
- Low headroom—stacks materials higher than any other hoist.
- Safe, fool-proof.
- Compact, strong, simply constructed.
- Protected against dust, moisture, fumes.
- Heavy duty, ball-bearing HOIST SERVICE motors.
- Automatic lowering brake.
- Ball or roller bearings at vital points.
- Improved plow-steel cable.
- 100% positive automatic stop.
- Efficient spur-gear drive . . . and

LO-HED COSTS LESS PER LIFT

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A-E-CO Lo-Hed HOISTS

AMERICAN ENGINEERING COMPANY

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Roosevelt Refuses to Speak Before Chamber of Commerce

WASHINGTON—Highlighting its theme "The Key to Recovery," the 27th annual meeting of the Chamber of Commerce of the United States got under way here Monday with an attendance of some 2000 business men to seek a way for new jobs through the creation of new enterprises or expansion of old ones, as urged by President George H. Davis in his opening speech. To this end the Chamber was to conclude its meeting Thursday with the adoption of resolutions asking for the modification of restrictive laws in order to restore the flow of capital.

Running through the meeting there was evident a lack of optimism, rather than marked gloom, over the business outlook. Chiefly the blame was laid at the door of the Administration for erecting obstacles in the way of recovery. Prominent among these obstacles were those outlined by John W. O'Leary, chairman of the Chamber's executive committee and of Arthur J. O'Leary & Son Co., Chicago manufacturer of bolts, forgings and tools.

Addressing the National Council of the Chamber, Mr. O'Leary said that business is developing more strongly the feeling that it is desirable to:

Remove uncertainties of the future due to Government controls beyond those needed to correct abuses.

Revise those laws which create strife and separate labor and management so as to restore again the mutual regard and recognition of joint interests.

Revise tax laws so as to follow the rule of revenue purposes rather than reform.

Stop unnecessary Government spending and lessen Government expenditures so as to bring approach to a balanced budget with resultant confidence.

So modify our restrictive laws as to restore the flow of capital.

Words Into Action

"We have had 'word' assurance from both the Administration and from Congress of encouragement toward business," said Mr. O'Leary. "There is need now that the 'word' assurance be translated into action."

A word of assurance from the Administration had been expected. But it was not forthcoming. The President himself, after a lapse of five years, was invited to address the Chamber, the hope having been that strained relations between the two might be softened, if not overcome. The President, however, replied that pressure of foreign affairs would prohibit his acceptance of the invitation. To many this answer was considered a rebuff, particularly so since Mr. Roosevelt has promised to address the convention of the American Retail Federation in Washington later this month. After the President's declination to address the Chamber it turned to other Administration representation and asked Secretary of Commerce Harry L. Hopkins to address it. Mr. Hopkins accepted the invitation and was to speak on "What the Federal Government Can Do to Help." At the last moment, owing to illness, Mr. Hopkins was compelled to cancel the speech. Though Mr. Hopkins' unfortunate condition was a legitimate reason for his failure to ad-



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dress the Chamber, there is no question but that the absence of Administration recognition heightened the Chamber's ill-feeling toward the New Deal.

Mr. Davis told the convention that there seems to be general agreement that three things are necessary to "break the log jam" that is holding back business-incentive, new ideas and money.

Reforms are necessary, he continued, "but when there are too many reforms, all at once, and those ill-advised and not readily digested, then the slowing down of incentive amounts to murder—to killing off of that incentive, such as the situation we have today."

Another drawback to incentive was said to be the increasing burden laid on business by the "tax-gatherer," which Mr. Davis declared, is slowly but surely, crushing the business structure.

"The manufacturer with an improved product at less cost not only gets the market," it was pointed out, "but also actually takes the measure of his own contribution to industrial progress, and to consumer welfare. In this way, he contributes to higher standards of living and of civilization."

Great Pent-Up Demand

In emphasizing that the flood of capital into old and new enterprises has been the greatest single force which pulled the country out of past depressions, the Chamber said "that great instrument of improvement has been all but missing." It was stated that by contrast with the $3,750,000,000 that prior to 1930 went into new capital issues each year, since then an average of less than one-fifth of that amount has been flowing annually into business through new issues.

"Investments mean jobs," it stated, "for the typical job in industry there is invested on the average per workman, in plant, tools, and equipment about $8,600; in some lines of business much more, as, for instance, in the large steel industry about $11,500.

"These are estimates of the capital needs of business which range from $40,000,000,000 to more than twice that sum. We all know there is a tremendous pent-up need for expenditures upon capital goods. The potential demand for industrial machinery alone was estimated a few years ago to be in excess of $18,000,000,000.

"It is estimated that if we supplied capital needs up to $25,000,000,000, there would be provided employment for some three million men in operating the plant and equipment and work for some two to two-and-one-half times that number in the service industries."

Perhaps feeling more or less isolated from the administrative branches of the Government, and at the same time aware of Congress's reasserted power over legislation, business representatives from 46 states who are attending the Chamber meeting took a unique way to tell their troubles and the troubles of voting constituencies to the lawmakers. They discussed economic recovery informally with senators and representatives at 26 dinners, attended by more than half of the members of Congress. The dinners were held independently of one another and of the Chamber.

"The purpose," said the Chamber, "is to provide an opportunity for better acquaintance between business men and their senators and representatives . . . in furtherance of the common effort to promote economic recovery."

LEADERSHIP



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9110

. . . GREAT BRITAIN . . .

. . . Government priorities introduced . . . England importing semi-finished steel.

LONDON, May 2 *(By Cable)*—Export demand is cramped by the international situation, but production is going ahead on armaments and defence, and Government priorities have been introduced. Semi-finished supplies are to be augmented by shipments from the Continent and Australia.

A further increase in shipbuilding orders insures a marked future activity in plates and angles, and there are large inquiries for new ship tonnage.

The Continent reports an increase in steel business, especially with United Kingdom, northern Europe and South America. Delivery delays are lengthening in some cases up to 10 weeks. The Continent is reported to have secured part of the Locust barrier order in Argentina.

The tin plate market is strong and there is activity in both home and export fields. Home consumers are covering up to the end of the year. Unfilled orders of over 4,750,000 base boxes is expected to reach 5,000,000 shortly as large inquirities are circulating. Makers are anxious over future steel prices which are fixed till the end of June delivery.

. . . CANADA . . .

. . . British orders boost Dominion Steel's operations.

TORONTO, May 2—Canadian iron and steel markets are lacking in interest so far as domestic demand is concerned, but there are prospects of additional buying from Great Britain. Dominion Steel & Coal Corp. has announced that its Sydney, N. S., plant has been stepped up to 100 per cent operation as a result of British orders and this rate is assured until the end of June at least. Word has been received that other new contracts have just been closed which will provide additional business to both Dominion Steel and the Steel Co., of Canada, Ltd., Hamilton, Ont.

Canadian prices are holding firm, with no changes in prospect for the immediate future, according to local interests.

Pig iron production in March reached a new low for the year at 40,723 gross tons against 41,333 tons in February, but it is expected that one or two furnaces will be blown in at once. At present three furnaces are in blast. Output of steel ingots and castings in March at 95,697 tons compares with 77,179 tons in February.

Merchant pig iron sales, while showing minor improvement, continue below the average for last year. It is stated that most of the large melters in and around Toronto are covered for immediate needs.

. . . PIPE LINES . . .

Corpus Christi Recycling Corp., Corpus Christi, Tex., has approved plans for new 4½-in. welded steel pipe line from recycling plant to vicinity of turning basin at Corpus Christi waterfront, about 32 miles, for gasoline transmission. Cost over $125,000 with booster station and other operating facilities.

Lancaster, Ohio, is considering new welded steel pipe line from city limits to new gas field near Corning, Ohio, close to 40 miles, for natural gas transmission to municipality, where control station and operating facilities will be provided. Estimates of cost will be made soon.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 12 for steel pipe and steel tubing for Norfolk Navy Yard, Portsmouth, Va. (Schedule 6184).

Atlantic Refining Co., 260 South Broad Street, Philadelphia, plans welded steel pipe lines in connection with new natural gas recycling plant in gas field district at Weslaco, Hidalgo County, Tex., work to begin soon. Entire project to cost over $500,000.

Standard Oil Co. of California, 225 Bush Street, San Francisco, plans new submarine steel pipe line in Columbia River, near Umatilla, Ore., for oil transmission. Mooring pier and other facilities will be built.

Marlow, Okla., plans steel pipe lines for natural gas distribution, including control station and other operating facilities. Cost close to $75,000.

Shell Union Oil Corp., 50 West Fiftieth Street, New York, plans about 10,000 ft. of steel pipe line for oil and gasoline transmission in connection with new bulk terminal plant on James River, about five miles from Richmond, Va., where tract has been acquired.

Purchasing and Contracting Officer, Quartermaster Corps, Fort Benning, Ga., closes bids May 10 for 2500 ft. of steel pipe (Circular 148-117).

Warren Petroleum Corp., National Bank of Tulsa Building, Tulsa, Okla., has let contract to National Tube Co., Pittsburgh, for steel pipe for pressure lines for new natural gasoline plant in Fairbanks oil field area, Harris County, Tex., on which work will begin soon. Entire project will cost about $250,000.

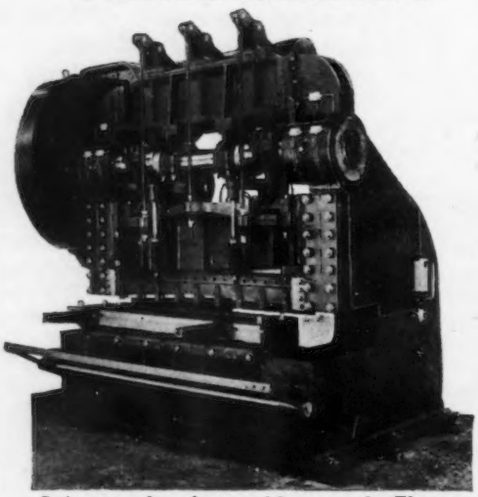
Constructing Quartermaster, Chanute Field, Ill., asks bids until May 9 for about 4000 ft. of steel pipe; also for pipe caps, pipe plugs, nipples, couplings and other fittings (Circular 6627-59).

PUNCHES • SHEARS • SPACING TABLES

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FABRICATED STEEL

... Lettings lower at 11,950 tons as against 19,200 tons last week ... New projects decline to 29,350 tons from 43,220 tons a week ago ... Plate awards total 17,470 tons.

NORTH ATLANTIC STATES
AWARDS

1080 **Tons,** New York, sanitation garage, 215th Street, for Procurement Division, to American Bridge Co., Pittsburgh.

550 **Tons,** Buffalo, W. T. Grant & Co. store, to Bethlehem Steel Co., Buffalo, through A. J. Hartridge & Co., New York, general contractors.

370 **Tons,** Washington, Taylor Street grade separation bridge, to American Bridge Co., Pittsburgh.

365 **Tons,** Camden, N. J., building extension. New York Shipbuilding Corp., to Robinson Steel & Iron Co., Philadelphia.

275 **Tons,** Lawrence, Mass., Garden and Union Street bridge, to Phoenix Bridge Co., Phoenixville, Pa., Louis C. Cyr, Lawrence, contractor.

240 **Tons,** New York, building addition, North Beach Airport, to Bethlehem Steel Co., Bethlehem, Pa.

130 **Tons,** Bernardston, Mass., grade crossing, to Bethlehem Steel Co., Bethlehem, Pa., through Kelleher Construction Co., Montague, Mass., contractor.

110 **Tons,** Pope's Creek, Md., pile driver tower, to Lehigh Structural Steel Co., Allentown, Pa.

SOUTH AND SOUTHWEST

275 **Tons,** Pickwick Dam, Tenn., floating boom, to Ingalls Iron Works Co., Birmingham.

125 **Tons,** Grenada County, Miss., bridge, to Vincennes Bridge Co., Vincennes, Ind.

125 **Tons,** Hillside, Ariz., Santa Maria River bridge, to Allison Steel Co., Phoenix, Ariz.; through Phoenix Tempe Stone Co., Phoenix, contractor.

110 **Tons,** Fort Smith, Ark., Kress & Co., store, to Fort Smith Structural Steel Co., Fort Smith.

110 **Tons,** Panola County, Miss., bridge to Jones & Laughlin Steel Corp., Pittsburgh.

CENTRAL STATES

2000 **Tons,** Pittsburgh, Wilmot Street bridge, to Fort Pitt Bridge Works Co., Pittsburgh.

1200 **Tons,** Kansas City, Mo., food market, to Mississippi Valley Steel Co., St. Louis.

800 **Tons,** Chicago, 122nd Field Artillery Armory, to Fort Pitt Bridge Works Co., Canonsburg, Pa., through George Sollitt Construction Co., Chicago.

800 **Tons,** Mazon, Ill., highway bridge, to Bethlehem Steel Co., Bethlehem, Pa.

260 **Tons,** Austin, Ind., Morgan Packing Co., warehouse, to Central States Bridge & Structural Co., Indianapolis.

250 **Tons,** Toledo, Ohio, bridge repairs, New York Central Railroad, to American Bridge Co., Pittsburgh.

240 **Tons,** Winnetka, Ill., overhead bridges, to Bethlehem Steel Co., Bethlehem, Pa., through Minder Construction Co., Chicago.

241 **Tons,** Grand County, Ill., highway bridge, to American Bridge Co., Pittsburgh, through Frank Kenney.

220 **Tons,** Detroit, Federal Department Store, Inc., to J. L. Peters Co., Detroit.

198 **Tons,** East St. Louis, Ill., highway bridge, to Bethlehem Steel Co., Bethlehem, Pa.

126 **Tons,** Mazon, Ill., highway bridge, to Midland Structural Steel Co., Cicero, Ill.

WESTERN STATES

750 **Tons,** Palo Alto, Calif., Hoover War Memorial, to Bethlehem Steel Co., San Francisco.

250 **Tons,** Grand County, Colo., highway bridge, to American Bridge Co., Pittsburgh.

200 **Tons,** Odair, Wash., Grand Coulee pumping plant, to Schmitt Steel Co., Portland, Ore.

190 **Tons,** Las Animas County, Colo., highway bridge, to Midwest Steel & Iron Works Co., Denver, through George W. Condon Co., Denver.

180 **Tons,** Los Angeles, transmission towers for Edison Co., to International Derrick & Equipment Co., Los Angeles.

160 **Tons,** East Warren, Wyo., Fort Francis. gymnasium building, to Pittsburgh Des Moines Steel Co., Pittsburgh.

PENDING STRUCTURAL PROJECTS

NORTH ATLANTIC STATES

1800 **Tons,** Boston, extension to structural shop for Navy Department.

700 **Tons,** Middletown, N. Y., high school.

350 **Tons,** New York, building alterations for 49 East 52nd Street Corp.

325 **Tons,** Eden, N. Y., school building.

300 **Tons,** Towson, Md., shop and laboratory building for subsidiary of Bendix Aviation Corp.

175 **Tons,** Iona Island, N. Y., extension to wharf for Navy Department.

140 **Tons,** Newark, N. J., Our Lady of Good Counsel Church building.

125 **Tons,** Forest Hills, N. Y., building for New York Telephone Co.

125 **Tons,** Portsmouth, N. H., ship fitter's building.

100 **Tons,** Groton, Conn., Electric Boat Co. model and joiner shop.

THE SOUTH

11,000 **Tons,** Greenville, Miss., superstructure for bridge across Mississippi River; bids due May 16.

9000 **Tons,** Natchez, Miss., superstructure for bridge across Mississippi River; bids due May 19.

361 **Tons,** Nacogdoches, Tex., highway bridge; bids in.

295 **Tons,** Kaufman, Tex., highway bridge; bids in.

CENTRAL STATES

1800 **Tons,** Cleveland, Upper West Third Street bridge (includes operating machinery); bids soon.

500 **Tons,** Woodstock, Ill., manufacturing building for Electric Auto Lite Co.

450 **Tons,** St. Paul, Minn., Jackson Street viaduct; bids May 12.

200 **Tons,** Cleveland, Valleyview Housing project; Sam W. Emerson Co., Cleveland, low bidder.

150 **Tons,** Urbana, Ill., Union building for University of Illinois; bids May 16.

150 **Tons,** Minneapolis, South Side destructor plant.

150 **Tons,** Casselton, N. D., State underpass.

125 **Tons,** Detroit, manufacturing plant for Gelatin Products Co.

125 **Tons,** Chicago, apartment buildings for River Forest Garden Apartment Corp.

125 **Tons,** St. Louis, Government office and warehouse building.

WESTERN STATES

400 **Tons,** San Francisco, Best Foods warehouse; bids in.

140 **Tons,** Los Angeles, Bureau of Public Works bridge; bids May 10.

113 **Tons,** Aurora, Col., highway bridge; bids May 11.

100 **Tons,** Oakland, Cal., telephone building.

FABRICATED PLATES

AWARDS

4200 **Tons,** Ashland, Ky., 30 coal barges for American Rolling Mill Co.; 2800 tons to Marietta Mfg. Co., Point Pleasant, Va., 1400 tons to St. Louis Shipbuilding Co., St. Louis.

11,000 **Tons,** Toledo, sections C, D, E of 78-in. intake line for city, to Bethlehem Steel Co., Bethlehem, Pa., through Walter McGee Co., Minneapolis.

1100 **Tons,** Elwood, Neb., pipe line for Central Nebraska Public Power and Irrigation District, to Chicago Bridge & Iron Co., Chicago.

657 **Tons,** Cincinnati, Ohio, three barges for Standard Oil Co. of Ohio, to Nashville Bridge Co., Nashville, Tenn.

400 **Tons,** Richmond, Va., four tanks for Shell Union Oil Corp., to Chicago Bridge & Iron Co., Chicago.

110 **Tons,** Los Angeles, tunnel liners for U. S. Engineers, to Commercial Shearing & Stamping Co., Youngstown, Ohio.

PENDING BROJECTS

Unstated tonnage, Rutledge, Tex., 24 102-in. ring follower gates with hoists and appurtenances for Bureau of Reclamation (Specifications 847); bids May 31.

SHEET PILING

PENDING PROJECTS

1250 **Tons,** Cleveland, bulkhead cut No. 6, contract No. 7; Great Lakes Dredge & Dock Co. low bidder (previously noted).

663 **Tons,** Los Angeles, H-type bearing piles for United States Engineer (Proposal 215); bids in.

U. S. Steel Salaried Workers on 5 Days

PITTSBURGH—Effective May 1, all salaried employees of U. S. Steel Corp and subsidiaries went on the basis of a maximum five day work week which represents a nine and one-tenth per cent cut in weekly salaries for those whose time was cut from a five and a half day week. Present low rate of operations was given by the company as the reason for the latest move which is a reversal of the Jan. 1 announcement when the majority of white collared workers went from a five day week to a five and a half day week. As the salaries of higher executives were not restored on Jan. 1 they remain unaffected by the current order since they are already on a five day salary basis.

Engineer's Importance Grows, Girdler Tells Case Men

CLEVELAND—Industry's obligation to science includes close support for privately endowed educational institutions, particularly the technical schools, said T. M. Girdler, chairman, Republic Steel Corp., and president, American Iron and Steel Institute, at a dinner meeting of Case School of Applied Science here May 1.

"Not only is the engineer today the key figure on the production side of industry, but he is rapidly emerging as an increasingly important figure on the sales side," said Mr. Girdler. "His great technical skill, which heretofore has been directed principally at engineering product manufacture, is now being directed more and more at engineering product distribution.

"The unexplored fields of science are so vast, there is so much to be discovered, that with the work of all, with the technical schools greatly supplementing and assisting the work of the industrial laboratories, we are just beginning to scratch the surface," he said.

T. C. I. to Manufacture Corrugated Culverts

THE Tennessee Coal, Iron & Railroad Co., Birmingham, is preparing to enter the corrugated culvert field, Robert Gregg, president, announced. Equipment for manufacture of this new product is being installed



L. H. SHELLEY

in the company's fabricating shop at Fairfield works, Mr. Gregg said. Both plain galvanized and asphalt-coated culverts will be made. Culverts will be manufactured in all standard sizes and gauges.

M. H. Geisking, vice-president and general manager of sales, announced a new division of the sales department to handle sale of culverts with L. H. Shelley as manager of sales.

Packard Prices Are Cut By $100 to $300

DETROIT—The Packard Motor Car Co. on Monday announced price reductions ranging from $100 to $300 in the Packard six, 120 and super eight groups of 1939 models. The reductions, according to M. M. Gilman, newly elected president of the company, climax a four-year expansion program.

"We feel that conditions at this time are particularly auspicious for this price adjustment," Mr. Gilman said. "Total factory and field inventories are 18 per cent lower than last year. This permits us to change over to the new production basis without costly delays. Orders from the field are daily showing a marked upturn."

Schwab, Honored As Nation's No. 1 Salesman, Denies It

CHARLES M. SCHWAB, if he were young enough, would be Tom M. Girdler's candidate for president to bring the country out of the depression, Mr. Girdler declared at a New York Sales Executives Club dinner honoring the founder of Bethlehem Steel Corp.

Scores of executives high in American industry turned out at the dinner to praise Mr. Schwab as the nation's "super-salesman." Said Mr. Schwab; "There are at least a hundred men in my company who are better salesmen than I."

Seated at the head of the table at the Schwab dinner in the Hotel Roosevelt were such industrial leaders as L. E. Block, chairman, Inland Steel Co.; F. B. Hufnagel, chairman, Crucible Steel Co. of America; Gerard Swope, president, General Electric Co.; William A. Irvin, former president, United States Steel Corp.; H. E. Lewis, chairman, Jones & Laughlin Steel Corp.; William B. Bell, president, American Cyanamid Co.; W. L. Lewis, president, Chicago Pneumatic Tool Co.; Edward L. Parker, president, Columbia Steel & Shafting Co., John F. Havemeyer, chairman, Concrete Steel Co.

Also George H. Houston, president, Baldwin Locomotive Works; C. D. Caldwell, president, Interlake Iron Corp.; Frank R. Frost, president, Superior Steel Co., and Charles S. Munson, president, Air Reduction Co.

Mine Strike Hits Steel Consumers

PITTSBURGH—The shutdown at bituminous mines in the Appalachian regions and the threat of curtailment in all coal mining operations by May 4, due to the feud between John L. Lewis, CIO chieftain, and William Green, A. F. of L. head, has so far produced little direct effect on actual raw steel output. Indirectly, however, steel consumers have been embarrassed to some extent, which has had some adverse influence on demand for steel products. Major steel companies are fairly well fixed for the next several weeks on coke for pig iron production but continue to keep blast furnace operations at a minimum consistent with daily requirements. Some isolated plants have been scouring the market for steam coal to insure operations of power plants.

Armco Promotes Wortley and Woods

FOSTER E. WORTLEY, district manager of Cleveland for American Rolling Mill Co., has been appointed assistant manager of Midwestern sales with headquarters at



F. E. WORTLEY

Middletown, Ohio, under JOHN A. INGWERSEN, manager of Midwestern sales. Mr. Wortley joined the company in 1912 in New York and was advanced to assistant district manager there. In 1929 he was moved to Pittsburgh as assistant district manager. In 1932 he went to Cleveland as district manager.

HENRY WOODS of the Detroit office of American Rolling Mill Co., has been appointed district manager at Cleveland.

Irvin Works Breaks Cold Strip Record

PITTSBURGH—On April 27, on the 4 to 12 midnight turn, the 42-in. five stand tandem cold reducing mill, tin mill department, Irvin works, Carnegie-Illinois Steel Corp., broke a previous production record by turning out 446.6 gross tons of cold reduced strip for tin plate.

The mill's previous record was made March 16 when 315.79 gross tons were produced. This compares with an estimated average of 300 gross tons during a normal run. The material produced during the 8-hr. turn when the most record was made was strip 29½-in. wide, representing a gage equivalent to 107 lb. per base box tin plate.

April Daily Pig Iron Output Down 12.3 Per Cent

PARTLY estimated production of coke pig iron in April on a daily basis dropped 12.3 per cent from that in March, or from a revised figure of 77,246 gross tons a day in March to 67,775 tons in April. Output totaled 2,033,259 tons, compared with 2,394,615 tons in March.

There were 102 furnaces in blast on May 1 compared with 123 furnaces on April 1. One furnace was blown in, six were blown out and 16 were banked. The United States Steel Corp. banked 11 furnaces and blew one out. Independent producers banked five furnaces and blew out five, and merchant producers blew in one furnace.

Furnaces blown out or banked included: One Donora, American Steel & Wire Co.; two Duquesne, one Edgar Thomson, one Ohio, one Farrell, one South Chicago (old), one South Chicago (new), and one Gary, Carnegie-Illinois Steel Corp.; three Ensley, Tennessee Coal, Iron & Railroad Co.; one Susquehanna, one Zug, National Steel Corp.; one Cambria, Bethlehem Steel Co.; one Haselton, one River and one Betty, Republic Steel Corp.; one Riverside, Wheeling Steel Corp.; one Madeline, Inland Steel Co.; and one Campbell and one Hubbard, Youngstown Sheet & Tube Co.

The only furnace blown in was that of the E. & G. Brooke Iron Co.

REINFORCING STEEL

ATLANTIC STATES AWARDS

8000 Tons, Washington, Social Security building and Railroad Retirement building, to Sweets Steel Co., Williamsport, Pa., through McCloskey & Co., Philadelphia, contractors.

1640 Tons, New York, approach, Harlem River Speedway-George Washington Bridge, to Joseph T. Ryerson & Son, Inc., New York, through Northeastern Construction Co., New York.

500 Tons, Panama Canal, Schedule No. 3445, to Bethlehem Steel Co., Bethlehem, Pa., through Virginia Steel Co.

425 Tons, Washington, Rock Creek sewer, to Truscon Steel Co., Youngstown, through James Lombardi, Philadelphia, contractor.

300 Tons, Washington, Taylor Street viaduct, to Bethlehem Steel Co., Bethlehem, Pa., through H. R. Dickens, Philadelphia, contractor.

250 Tons, Philadelphia, Nazareth Hospital addition, to Sweets Steel Co., through McCloskey & Co., contractors.

160 Tons, Norfolk, Va., Navy Yard, Requisition 1006 ER, to Bethlehem Steel Co., through Virginia Steel Co., low bidder.

150 Tons, Harrisburg, Pa., State Liquor Control building, to Sweets Steel Co., through McCloskey & Co., general contractors.

150 Tons, Southborough-Framingham, Mass., aqueduct, to Truscon Steel Co., through B. A. Gardetto Co., Roxbury, Mass., contractor.

100 Tons, Lorton, Va., sewage disposal plant, to Jones & Laughlin Steel Corp., Pittsburgh, through Taylor-Davis, Inc., Philadelphia; Engstrom & Wynn, Inc., contractors.

CENTRAL AND WESTERN STATES

2000 Tons, Los Angeles, United States Engineer (Proposal 210), to Columbia Steel Co., San Francisco.

950 Tons, Rantoul, Ill., air corps barracks, to Joseph T. Ryerson & Son, Inc., Chicago, through Lipman Construction Co., Chicago.

500 Tons, Chicago, Western Avenue viaduct substructure, to Joseph T. Ryerson & Son., Inc., through Thomas McQueen, Chicago.

500 Tons, Joplin, Mo., viaduct, to Sheffield Steel Corp., Kansas City, through Concrete Products Co.

475 Tons, Marshalltown, Iowa, sewage plant, to Pittsburgh-Des Moines Steel Co., Pittsburgh, through Lippert Construction Co., contractor.

400 Tons, Arrowhead Springs, Cal., hotel, to Ceco Steel Products Co., Los Angeles, through William Simpson Construction Co.

368 Tons, Calexico, Cal., power plant and intake structure for Imperial Irrigation District, to Consolidated Steel Corp., Los Angeles, through Vinson & Pringle, Phoenix, Ariz., contractors.

300 Tons, Palo Alto, Cal., Hoover War Memorial, to Simmons Co., San Francisco.

300 Tons, Buena, Wash., Yakima project (Invitation A-33846-A), to Bethlehem Steel Co., San Francisco.

300 Tons, Kenosha, Wis., waterworks, to Truscon Steel Co., Youngstown.

268 Tons, Chicago, plant addition, Chicago Flexible Shaft Co., to Joseph T. Ryerson & Son, Inc., Chicago, through Campbell, Lowrie & Lautermilch Co., Chicago.

250 Tons, Des Moines, Iowa, grain elevator, to Laclede Steel Co., St. Louis, through James Stewart Co., contractor.

170 Tons, Cincinnati, Ludlow Avenue viaduct, to Joseph T. Ryerson & Son, Inc., through P. E. Hickey, Cincinnati.

161 Tons, Engle, N. M., Rio Grande project (Invitation A-8837-A), to Laclede Steel Co., St. Louis.

135 Tons, Inglewood, Cal., mausoleum, to Soule Steel Co., Los Anegels.

132 Tons, Sunol, Cal., bridge, to San Jose Steel Co., San Jose, Cal., through Caputo & Keeble, San Jose, contractors.

128 Tons, Wisconsin Rapids, Wis., sewage treatment plant, to Truscon Steel Co., Youngstown, through Kroenig Engineering Co., Milwaukee.

109 Tons, Buena, Wash., Yakima project (Invitation 33845-A), to Bethlehem Steel Co., San Francisco.

101 Tons, El Monte, Cal., high school auditorium, to Consolidated Steel Corp., Los Angeles, through Steed Brothers, contractors.

PENDING REINFORCING BAR PROJECTS

ATLANTIC STATES

750 Tons, New York, substructure, Criminal Courts building.

600 Tons, Washington, Soldiers reservoir; A. K. Wikstrom, low bidder.

600 Tons, Washington, outfall relief sewer, Bolling Field.

590 Tons, Clinton County, N. Y., mostly mesh, but includes 85 tons of structural steel, highway project R.C. 4015; bids close May 23.

492 Tons, Newark, N. J., housing project, first contract; bids in.

260 Tons, Peabory-Danvers, Mass., bridge over Boston & Maine Railroad.

250 Tons, Pope's Creek, Md., superstructure, Potomac River bridge; bids May 10.

117 Tons, Cabell County, W. Va., grading, draining and paving; bids May 2.

112 Tons, New York, freight terminal, New York Central Railroad.

CENTRAL AND WESTERN STATES

1700 Tons, Gary, Ind., sewage treatment plant, Permanent Construction Co., Chicago, low bidder.

970 Tons, Pollock, Cal., Central Valley project (Invitation 33208-A); bids in.

850 Tons, Omaha, housing project.

800 Tons, Cleveland, Balleyview housing project. Sam W. Emerson Co., Cleveland, low bidder.

350 Tons, Mare Island, Cal., Navy paint shop and storage building; bids May 10.

300 Tons, San Francisco, Holly Park low cost housing project; bids May 9.

300 Tons, Chicago, superstructure, South Side vocational school; bids April 25.

130 Tons, Cincinnati, Sixth Street viaduct superstructure.

113 Tons, Pasadena, Cal., Avenue 43 bridge over Arroyo Seco; bids May 18.

100 Tons, Detroit, Oakwood connecting sewer.

Unstated tonnage, Cleveland, Luna Park housing project; bids soon.

Unstated tonnage, Columbus, Battelle Memorial Institute laboratory building; bids May 9.

Unstated tonnage, Barberton, Ohio, industrial arts building and gymnasium; bids May 13.

CAST IRON PIPE

New London, Conn., has taken under advisement bids on 500 tons for force mains.

Providence, R. I., has closed bids on 396 tons of 6, 8, 12 and 30-in. pipe.

Hopkinton, Mass., closed bids May 3 on 125 tons of 10-in. pipe, hydrants, valves and valve boxes.

Decatur, Ga., plans pipe lines for water system and other waterworks installation. Cost reported over $200,000. Robert & Co., Bona Allen Building, Atlanta, Ga., are engineers.

Oak Harbor, Ohio, closes bids May 10 for main pipe line from city limits to Port Clinton, Ohio, about 11 miles, for water supply; also for 100,000-gal. elevated steel tank and tower, and other waterworks installation. Champe, Finkbeiner & Associates, Nicholas Building, Toledo, Ohio, are consulting engineers.

Board of Public Works, City Hall, Green Bay, Wis., asks bids until May 10 for pipe for water system and other waterworks installation.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 9 for cast iron soil and water pipe for Eastern and Western Navy yards (Schedule 6141).

Water Department, Dallas, Tex., Main and Harwood Streets, plans pipe line extensions and replacements in water system in different parts of city. Fund of about $570,000 is being arranged for this and extensions and improvements in sewage system.

Center Junction, Iowa, plans pipe lines for water system and other waterworks installation. Special election has been called to approve bond issue for work.

Raymond, Wash., plans pipe line extensions and replacements in water system near Butte Creek water shed. Cost about $24,600. Financing in part has been arranged through Federal aid. J. E. Buckingham is city engineer.

Meridian, Miss., is considering pipe line extensions and replacements in water system; also elevated steel tank and tower, and other waterworks installation. Proposed to arrange bond issue soon.

Henrico County Sanitary District No. 1, Highland Springs, Va., plans pipe lines for water system. A bond issue of $220,000 is being arranged for this and sewer system.

Water Bureau, Utica, N. Y., plans pipe line extensions and replacements in water system. Cost about $25,000. J. B. Shaw is city engineer.

Campbell, Tex., is considering pipe lines for water system. Fund of about $21,100 is being arranged for this and sewer system.

Sedro-Woolley, Wash., is negotiating for purchase of local water system, now privately owned, and will operate as municipal property. Extensions and replacements will be made in pipe lines in different areas. Parker & Hill, Smith Tower Building, Seattle, consulting engineers, will conclude arrangements for acquisition, and prepare plans for extensions.

National Park Service, Boulder City, Nev., has awarded 370 tons of 6 and 8-in. pipe to United States Pipe & Foundry Co., San Francisco.

Construction Quartermaster, Fort Lewis, Wash., has awarded 164 tons of 10 and 12-in. pipe to United States Pipe & Foundry Co., San Francisco.

Glendale, Cal., opens bids May 4 on 5800 ft. of 20-in. and 1200 ft. of 12-in. pipe (Class 250) with cement alternate.

Eugene, Ore., Bethel Water District, is taking bids on 3000 ft. of 8-in., 8110 ft. of 6-in., 9720 ft. of 4-in., and 2450 ft. of 2-in. pipe.

San Bernardino, Cal., has taken bids on 19,000 ft. of 4, 6 and 8-in. pipe.

Current Metal Working Activity

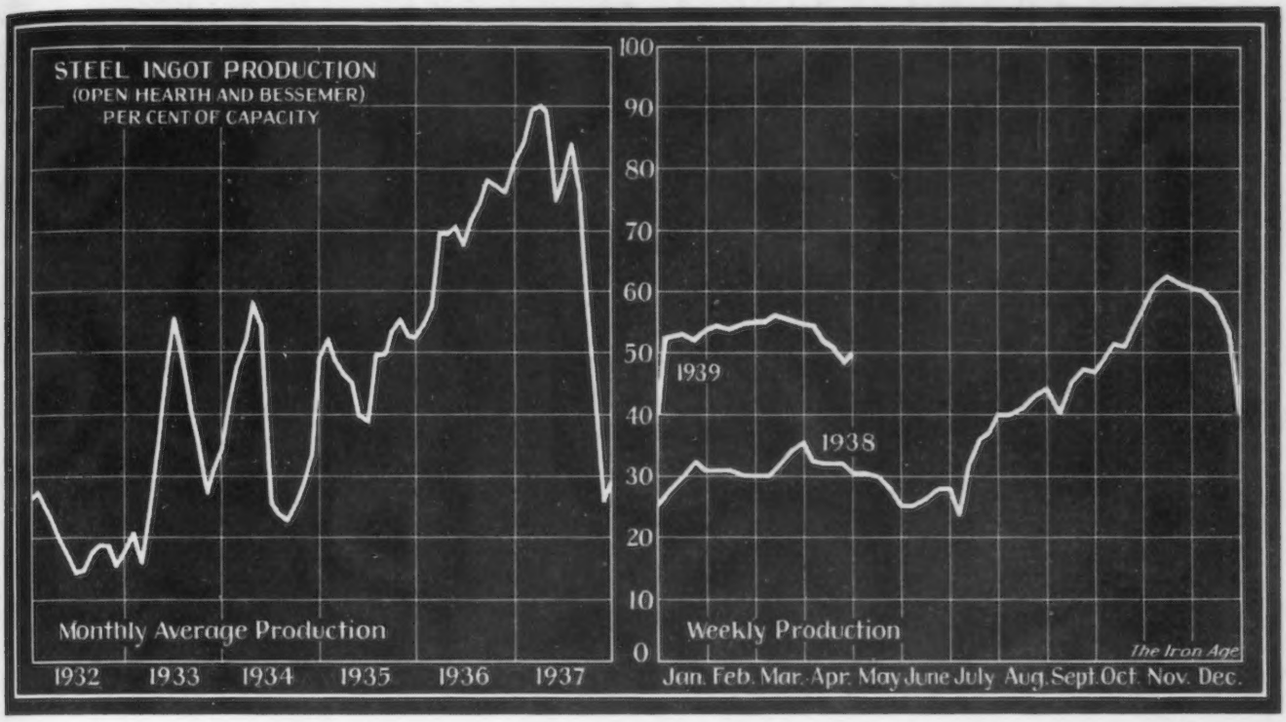
Latest Data Assembled by THE IRON AGE from Recognized Sources

	March 1939	February 1939	March 1938	Three Months 1939	Three Months 1938
Steel Ingots: (gross tons)					
Monthly output[a]	3,364,877	2,954,883	2,012,406	9,506,594	5,448,896
Average weekly output[a]	759,566	738,721	454,268	739,237	423,709
Per cent of capacity[a]	55.63	54.10	33.85	54.14	31.58
Pig Iron: (gross tons)					
Monthly output[b]	2,407,058	2,060,187	1,452,487	6,642,668	4,179,840
Raw Materials:					
Coke output[c] (net tons)	3,507,237	3,148,754	2,772,371	10,100,247	8,250,131
Lake Ore consumed[d] (gross tons)	3,316,691	2,852,540	1,980,182	9,095,937	5,679,823
Castings: (net tons)					
Malleable, orders[e]	35,997	33,234	20,556	107,336	57,189
Steel, orders[e]	.....	30,360	28,096	.....	88,146
Finished Steel: (net tons)					
Trackwork shipments[a]	6,481	4,250	4,822	13,640	10,971
Fabricated shape orders[f]	89,530	81,298	84,257	272,160	221,721
Fabricated plate orders[e]	29,784	22,903	38,052	73,198	79,301
U. S. Steel Corp. shipments[g]	767,910	677,994	572,199	2,235,209	1,565,244
Fabricated Products:					
Automobile production[h]	371,940	297,841	238,753	1,023,727	669,369
Steel furniture shipments[e]	$1,886‡	$1,775‡	$1,969‡	$5,473‡	$5,814‡
Steel boiler orders[e] (sq. ft.)	612‡	817‡	739‡	1,676‡	2,549‡
Locomotives ordered[i]	63	3	10	74	36
Freight cars ordered[i]	1,000	2,004	682	3,007	816
Machine tool index[j]	185.4	167.1	107.0	167.8†	100.4†
Foundry equipment index[k]	146.6	135.3	114.6	134.9†	94.4†
Non-Ferrous Metals: (net tons, U. S. only)					
Lead shipments[l]	.....	34,421	31,052	.....	96,110
Lead stocks[l]	.....	122,112	143,511	.....	.....
Zinc shipments[m]	45,291	39,723	33,528	127,758	80,556
Zinc stocks[m]	127,985	128,192	118,009	.....	.....
Tin deliveries[n] (gross tons)	4,755	4,105	4,555	13,190	14,525
Refined copper deliveries[o]	54,708	51,377	44,576	160,912	107,563
Refined copper stocks[o]	320,446	308,958	342,785	.....	.....
Exports: (gross tons)					
Total iron and steel[p]	.....	359,690	526,883	.....	1,573,817
All rolled and finished steel[p]	.....	110,766	130,938	.....	391,812
Semi-finished steel[p]	.....	14,472	30,021	.....	101,559
Scrap[p]	.....	222,704	334,742	.....	946,150
Imports: (gross tons)					
Total iron and steel[p]	.....	19,149	11,827	.....	61,047
Pig iron[p]	.....	603	746	.....	13,847
All rolled and finished steel[p]	.....	10,738	8,522	.....	40,478
British Production: (gross tons)					
Pig iron[q]	603,600	516,000	714,600	1,620,100	2,169,000
Steel Ingots[q]	1,170,900	971,100	1,115,800	2,953,700	3,254,800

† Three months' average. ‡ 000 omitted. * Preliminary.

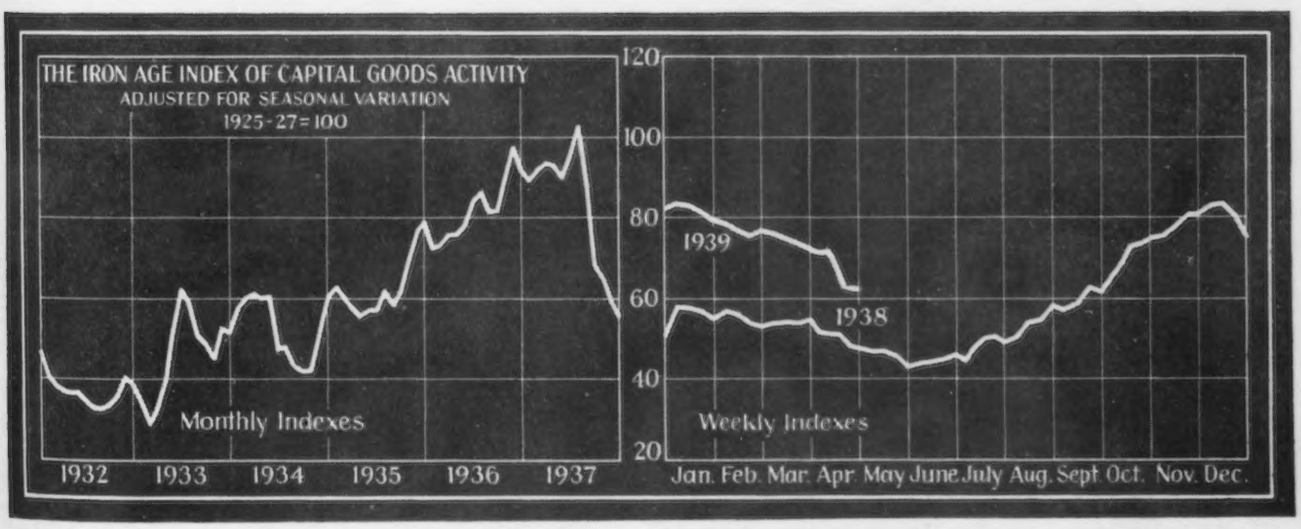
Source of data: [a] American Iron and Steel Institute; [b] THE IRON AGE; [c] Bureau of Mines; [d] Lake Superior Iron Ore Association; [e] Bureau of the Census; [f] American Institute of Steel Construction; [g] United States Steel Corp.; [h] Preliminary figures from Ward's Automotive Reports—Final figures from Bureau of the Census, U. S. and Canada; [i] *Railway Age;* [j] National Machine Tool Builders Association; [k] Foundry Equipment Manufacturers Association; [l] American Bureau of Metal Statistics; [m] American Zinc Institute; [n] New York Commodity Exchange; [o] Copper Institute; [p] Department of Commerce; [q] British Iron and Steel Federation.

Ingot Production Rises One-Half Point to 49%



District Ingot Production, Per Cent of Capacity	Pitts-burgh	Chicago	Valleys	Phila-delphia	Cleve-land	Buffalo	Wheel-ing	Detroit	Southern	S. Ohio River	Western	St. Louis	East-ern	Aggre-gate
CURRENT WEEK..	44.0	47.0	44.0	33.0	42.0	36.5	59.0	55.0	43.5	49.0	60.0	53.0	50.0	**49.0**
PREVIOUS WEEK..	45.0	49.5	38.0	34.0	35.0	41.5	56.0	55.0	43.5	49.0	60.0	41.0	50.0	**48.5**

Capital Goods Index Declines for Eighth Consecutive Week



PRODUCTIVE activity in the capital goods industry continues to ease off, according to THE IRON AGE index, which lost 3.1 points in the past week. The week's loss brings the index down to 61.2, the lowest position since the week ended Sept 17, 1938, and the eighth consecutive weekly decline. In most cases the losses in physical volume were greater than the seasonal trend, thus adding impetus to the downward movement. The lumber carloadings series, which advanced 0.9 points in the week, remains the only component to show signs of strengthening. The effect of the coal strike continues to be felt in the Pittsburgh index, but it is felt that some slackening in activity there would have been experienced regardless of the strike. Private construction awards rose slightly during the week, but a sharp decline in public contracts neutralized this improvement and left the combined total 10 per cent below the previous week.

	Week Ended Apr. 29	Week Ended Apr. 22	Comparable Week 1938	Comparable Week 1929
Steel ingot production[1]	61.1	65.0	39.3	131.0
Automobile production[2]	70.3	73.9	41.9	127.3
Construction contracts[3]	75.9	80.7	66.6	130.9
Forest products carloadings[4]	50.4	48.1	42.6	125.0
Production and shipments, Pittsburgh District[5]	48.3	53.9	49.0	125.1
Combined index	**61.2**	**64.3**	**47.9**	**127.9**

Sources: 1. THE IRON AGE; 2. Ward's Automotive Reports; 3. *Engineering News-Record*; 4. Association of American Railroads; 5. University of Pittsburgh.

. . . SUMMARY OF THE WEEK . . .

. . . Production decline halted in some districts.

° ° °

. . . Net loss of 21 blast furnaces in April, output down 12 per cent.

° ° °

. . . Industry looks for renewed automobile buying late in May.

THE downward trend of steel production in some districts has been at least temporarily halted. Although the two major districts, Pittsburgh and Chicago, have dropped slightly this week, there have been gains in the Youngstown, Cleveland-Lorain, Wheeling-Weirton and St. Louis districts, mainly due to an accumulation of orders and a desire to replenish ingot stocks which have been depleted during the past month. The average for the industry is up half a point to 49 per cent.

Having taken such precautionary measures as were necessary to guard against excessive use of coal and coke, the major steel companies are showing no great concern over the continued shutdown of soft coal mines in the Appalachian region. Most of the steel companies have coal supplies sufficient for six to eight weeks. If the pinch of coal shortage comes, it is more likely to affect many steel consumers sooner than steel producers.

During last month 22 steel company blast furnaces were taken off the active list, but of these 16 were banked and only six were blown out, indicating that producers are counting on a resumption of steel buying in the near future that will require the output of most of these furnaces. One merchant stack went in blast, so that the net loss for the month was 21 furnaces. U. S. Steel banked 11 furnaces and blew out one, while the independents banked five and blew out five.

These shutdowns resulted in a loss in production for April of more than 12 per cent. Output for the entire month was 2,033,259 tons against 2,394,615 tons in March, the daily rate dropping nearly 10,000 tons, or from 77,246 tons in March to 67,775 tons in April. There were 102 furnaces in blast on May 1 compared with 123 on April 1.

IF the crisis that looms over the Polish question is passed without the outbreak of war, it is the belief in the steel industry that a measure of confidence will be restored. Though the Washington situation remains discouraging from the standpoint of cooperation to free business from some of its shackles, there are definite prospects which may turn the trend upward by June. Chief among these is the probability of fairly large buying by the automobile companies, which are using up inventories in the completion of 1939 models. Purchases in good volume for 1940 models are expected not later than June 1. Inventories of steel in the hands of consumers and jobbers, with the possible exception of sheets and strip, are abnormally low and are not being built up. This fact is counted upon to aid steel buying if and when confidence returns. Tin plate orders are increasing and the production rate for the industry has been boosted to an average of 70 per cent. Structural steel prospects are still encouraging on top of March shipments of fabricated material which were the largest for any month since November, 1937.

Among new projects requiring structural steel are two bridges across the Mississippi River, one at Greenville, Miss., calling for 11,000 tons, and the other at Natchez, Miss., requiring 9000 tons. These jobs raise the total of new projects to more than 29,000 tons this week. Lettings were about 12,000 tons. Reinforcing steel awards were more than 19,000 tons, including 8000 tons for the Social Security Building in Washington. Plate awards of about 17,500 tons included 11,000 tons for an intake line at Toledo, Ohio, which went to the Bethlehem Steel Co.

Railroad buying is much lighter than during the earlier months of the year, but is still a factor. The Denver, Rio Grande & Western has ordered 550 cars and 100 underframes from the Pressed Steel Car Co., and the Maine Central has ordered 300 gondola cars from the Bethlehem Steel Co. The Great Northern is expected to buy 10,000 tons of rails this week, with a possibility of an additional 10,000 tons being bought in July.

THE tighter steel situation in Europe, where precedence is being given to armament programs, has brought additional steel business to the United States from South America and elsewhere, including an inquiry from the British government for about 100,000 tons of corrugated galvanized sheets for air raid shelters. It is understood here that similar inquiries have been sent to Canada and Australia. No orders have been placed here as yet for this material, but the business may be consummated shortly. Meanwhile, government priorities have gone into effect in England. To augment its own supplies, that country has imported semifinished steel from the continent and is likely to place large additional orders for scrap in the United States.

Domestic scrap markets have shown no sharp declines this week, although a slight downward adjustment at Philadelphia brings THE IRON AGE scrap composite price to a new low for the year to date, a decline of 8c. to $14.25.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics

Rails and Semi-finished Steel

Per Gross Ton:	May 2, 1939	Apr. 25, 1939	Apr. 4, 1939	May 3, *1938
Rails, heavy, at mill	$40.00	$40.00	$40.00	$42.50
Light rails: Pittsburgh, Chicago, Birmingham	40.00	40.00	40.00	43.00
Rerolling billets: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point.	34.00	34.00	34.00	37.00
Sheet bars: Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point	34.00	34.00	34.00	37.00
Slabs: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point	34.00	34.00	34.00	37.00
Forging billets: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham	40.00	40.00	40.00	43.00
Wire rods: Nos. 4 and 5, Pittsburgh, Chicago, Cleveland	43.00	43.00	43.00	47.00
Skelp, grvd. steel: Pittsburgh, Chicago, Youngstown, Coatesville, Sparrows Point, cents per lb.	1.90	1.90	1.90	2.10

Finished Steel

Cents Per Lb.:				
Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham	2.25	2.25	2.25	2.45
Plates: Pittsburgh, Chicago, Gary, Birmingham, Sparrows Point, Cleveland, Youngstown, Coatesville, Claymont	2.10	2.10	2.10	2.25
Structural shapes: Pittsburgh, Chicago, Gary, Buffalo, Bethlehem, Birmingham	2.10	2.10	2.10	2.25
Cold finished bars: Pittsburgh, Buffalo, Cleveland, Chicago, Gary	2.70	2.70	2.70	2.90
Alloy bars: Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton	2.80	2.80	2.80	3.00
Hot rolled strip: Pittsburgh, Chicago, Gary, Cleveland, Middletown, Youngstown, Birmingham	2.15	2.15	2.15	2.40
Cold rolled strip: Pittsburgh, Cleveland, Youngstown	2.95	2.95	2.95	3.20
Sheets, galv., No. 24: Pittsburgh, Gary, Sparrows Point, Buffalo, Middletown, Youngstown, Birmingham	3.50	3.50	3.50	3.80
Hot rolled sheets: Pittsburgh, Gary, Birmingham, Buffalo, Sparrows Point, Cleveland, Youngstown, Middletown	2.15	2.15	2.15	...
Cold rolled sheets: Pittsburgh, Gary, Buffalo, Youngstown, Cleveland, Middletown	3.20	3.20	3.20	...
Wire nails: Pittsburgh, Chicago, Cleveland, Birmingham	2.45	2.45	2.45	2.75
Plain wire: Pittsburgh, Chicago, Cleveland, Birmingham	2.60	2.60	2.60	2.90
Barbed wire, galv.: Pittsburgh, Chicago, Cleveland, Birmingham	†3.30	3.30	3.30	3.40
Tin plate, 100 lb. base box: Pittsburgh and Gary	$5.00	$5.00	$5.00	‡$5.35

On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

*Pittsburgh prices only.
†Applies to 80-rod spools only.
‡Subject to post-season adjustment.

Pig Iron

Per Gross Ton:				
No. 2 fdy., Philadelphia	$22.84	$22.84	$22.84	$25.84
No. 2, Valley furnace	21.00	21.00	21.00	24.00
No. 2, Southern Cin'ti	21.06	21.06	21.06	23.89
No. 2, Birmingham	17.38	17.38	17.38	20.38
No. 2, foundry, Chicago†	21.00	21.00	21.00	24.00
Basic, del'd eastern Pa.	22.34	22.34	22.34	25.34
Basic, Valley furnace	20.50	20.50	20.50	23.50
Malleable, Chicago†	21.00	21.00	21.00	24.00
Malleable, Valley	21.00	21.00	21.00	24.00
L. S. charcoal, Chicago	28.34	28.34	28.34	30.34
Ferromanganese, seab'd carlots	80.00	80.00	80.00	102.50

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$14.75	$14.75	$15.75	$11.75
Heavy melting steel, Phila.	15.25	15.50	15.75	12.25
Heavy melting steel, Ch'go	12.75	12.75	14.25	11.25
Carwheels, Chicago	12.50	12.50	13.00	13.00
Carwheels, Philadelphia	16.00	16.25	16.75	14.75
No. 1 cast, Pittsburgh	15.25	15.25	15.50	14.25
No. 1 cast, Philadelphia	16.50	16.75	16.75	15.25
No. 1 cast, Ch'go (net ton)	11.75	11.75	12.75	10.75

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.75	$3.75	$3.75	$4.00
Foundry coke, prompt	4.75	4.75	4.75	5.00

Non-Ferrous Metals

Cents per Lb. to Large Buyers:				
Copper, electrolytic, Conn.	10.25	10.00	10.75	10.00
Copper, lake, New York	10.25	10.25	11.375	10.125
Tin (Straits), New York	49.25	48.25	46.25	34.80
Zinc, East St. Louis	4.50	4.50	4.50	4.15
Zinc, New York	4.89	4.89	4.89	4.54
Lead, St. Louis	4.60	4.60	4.70	4.35
Lead, New York	4.75	4.75	4.85	4.50
Antimony (Asiatic), N. Y.	14.00	14.00	14.00	15.25

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
May 2, 1939	2.286c. a Lb.	$20.61 a Gross Ton	$14.25 a Gross Ton
One week ago	2.286	20.61	14.33
One month ago	2.286	20.61	15.25
One year ago	2.512	23.25	11.75

Finished Steel — Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strip. These products represent 85 per cent of the United States output.

	High	Low
1939		
1938	2.512c., May 17	2.211c., Oct. 18
1937	2.512c., Mar. 9	2.249c., Jan. 4
1936	2.249c., Dec. 28	2.016c., Mar. 10
1935	2.062c., Oct. 1	2.056c., Jan. 8
1934	2.118c., Apr. 24	1.945c., Jan. 2
1933	1.953c., Oct. 3	1.792c., May 2
1932	1.915c., Sept. 6	1.870c., Mar. 15
1931	1.981c., Jan. 13	1.883c., Dec. 29
1930	2.192c., Jan. 7	1.962c., Dec. 9
1929	2.223c., Apr. 2	2.192c., Oct. 29
1928	2.192c., Dec. 11	2.142c., July 10

Pig Iron — Based on average for basic iron at Valley furnace and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

	High	Low
1939		
1938	$23.25, June 21	$19.61, July 6
1937	23.25, Mar. 9	20.25, Feb. 16
1936	19.73, Nov. 24	18.73, Aug. 11
1935	18.84, Nov. 5	17.83, May 14
1934	17.90, May 1	16.90, Jan. 27
1933	16.90, Dec. 5	13.56, Jan. 3
1932	14.81, Jan. 5	13.56, Dec. 6
1931	15.90, Jan. 6	14.79, Dec. 15
1930	18.21, Jan. 7	15.90, Dec. 16
1929	18.71, May 14	18.21, Dec. 17
1928	18.59, Nov. 27	17.04, July 24

Steel Scrap — Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	High	Low
1939	$15.29, Mar. 28	$14.25, May 25
1938	15.00, Nov. 22	11.00, June 7
1937	21.92, Mar. 30	12.92, Nov. 10
1936	17.75, Dec. 21	12.67, June 9
1935	13.42, Dec. 10	10.33, Apr. 29
1934	13.00, Mar. 13	9.50, Sept. 25
1933	12.25, Aug. 8	6.75, Jan. 3
1932	8.50, Jan. 12	6.43, July 5
1931	11.33, Jan. 6	8.50, Dec. 29
1930	15.00, Feb. 18	11.25, Dec. 9
1929	17.58, Jan. 29	14.08, Dec. 3
1928	16.50, Dec. 31	13.08, July 9

. . . THIS WEEK'S MARKET NEWS . . .

STEEL OPERATIONS

. . . Downward trend checked in some districts . . . Average 49%

ALTHOUGH operations are slightly lower this week in the two most important districts, PITTSBURGH and CHICAGO, there has been a reversal of the recent downward trends in the YOUNGSTOWN, CLEVELAND - LORAIN, WHEELING - WEIRTON and ST. LOUIS districts, with the net result a rise of a half point in the estimate of THE IRON AGE for the entire industry to 49 per cent.

The rate for YOUNGSTOWN and vicinity is up six points to 44 per cent, the CLEVELAND-LORAIN rate is up seven points to 42 per cent, the WHEELING-WEIRTON rate has gained three points to 59 per cent, and the ST. LOUIS district has risen 12 points to 53 per cent.

The loss at PITTSBURGH was only one point, while CHICAGO declined two and a half points to 47 per cent. There was also a loss of one point in EASTERN PENNSYLVANIA. Other districts are operating at the same rates as a week ago.

Fluctuations in production may be expected from week to week under the present conditions. The placing of automobile tonnage, which is expected not later than June 1, may steady operations.

PRICES

. . . Reports of concessions on flat rolled products unconfirmed

SOME uneasiness has appeared with respect to current flat rolled steel quotations which has resulted in a considerable number of rumors to the effect that shading has increased. So far, however, no reliable facts have been uncovered which would indicate that sheet and strip prices are much, if any, less firm than was the case a month ago. Certainly no major "incident" similar to that of last October has taken place, and from the looks of fourth quarter and first quarter earnings reports, none is likely unless one or more producers attempt to obtain badly needed sheet tonnages by price concessions. If such a condition should arise, it is a foregone conclusion that the entire industry would meet such competitive prices as soon as they are uncovered.

In the CHICAGO district weakness is reported in bolts and nuts, fabricated shapes, reinforcing bars and some wire products. The general market is firm and it is not believed that price discussions on sheets for 1940 motor cars will be held until May 15 at least.

NEW BUSINESS

. . . General trend of orders is still downward

The total volume of April bookings at PITTSBURGH was off about 15 to 17 per cent from the March total, but on a daily basis the experience was a little more satisfactory owing to two less working days in April. Considerable variation occurred in individual companies and among various products. Fresh orders at PITTSBURGH in the past week are just about holding their own and producers look for no important changes until the general business picture is clarified. Moderate-sized tonnages of automotive fill-in orders were placed at the end of last week, reportedly at the published market prices.

CLEVELAND and YOUNGSTOWN steel producers finished April with order books thinner than at the start of the month. Shipments showed a lesser decline from March than did incoming business. Miscellaneous orders continue in fair volume. Export inquiry is reported prevalent for pig iron from Italy and Sweden, for barbed wire from South America, and for semi-finished steel. Export prices, however, remain generally unattractive for domestic mills. So far the coal strike has had very little effect upon Ohio mills.

April provided CHICAGO sellers with little encouragement. Bookings ranged from 12 to around 25 per cent lower than March and nothing in the immediate future indicates an improvement over the present situation.

Important sheet buying for 1940 cars is now expected by June 1.

Tractors continue the best seller in the farm equipment field, though industrial tractor demand also is good. Tillage and harvesting machinery business is slower than usual, demand being mostly for small equipment. Total sales for the industry are about 25 per cent under 1938.

CHICAGO rail mills are booked into June but beyond that month little tonnage will be available. Nearly all major roads have placed their 1939 requirements. The only railroad prospect for this quarter is the hope that some cars will be ordered, several thousand being outstanding.

Superstructures for two new bridges across the Mississippi River constitute the most important new business in the SOUTH. One is at Greenville, Miss., requiring 11,000 tons of structural shapes, and the other at Natchez, Miss., requiring 9000 tons, bids for which will be opened May 16 and 19 respectively.

Business in the ST. LOUIS area continues extremely dull. Consumers are hesitant about making commitments for any materials except for such jobs for which they have orders. This is true of all items.

Increase in buying of structural and reinforcing steel for private construction, together with large Government awards and new projects, was noted during the week on the PACIFIC COAST.

PIG IRON

. . . Shipments and sales are generally lower

OWING to the shutting down of coke production in the Connellsville beehive district, there has been a flurry of activity in by-product foundry coke as foundries seek to build up a little stock against a possible shortage of coke later on if the coal tie-up is protracted. At present there are ample supplies of by-product furnace coke, but foundry coke is harder to obtain. Some operators of by-product ovens are asking a premium of 50c. a ton over recently quoted prices.

As there is no fear of a shortage of pig iron in the near future, even though the coal tie-up is long drawn out, the coal and coke situation has given no impetus to pig iron demand. Some of the merchant furnaces have fairly large supplies of pig iron on the ground.

Sales and shipments of pig iron have, as a matter of fact, declined in some districts. Shipments by CLEVELAND and YOUNGSTOWN producers, for

example, fell off about 15 per cent in April as compared with March, while in the CHICAGO district shipments were off about 20 per cent, though foundry coke shipments were up 2 per cent.

New business has receded slightly at PITTSBURGH and producers look for a dull market for the coming months. Sales at ST. LOUIS and CINCINNATI are few, although in the latter district machine tool companies are operating at about 50 per cent. In Ohio a good many foundries are down to operations of two days a week.

Pig iron production in the SOUTH will be further reduced this week when the Tennessee Coal, Iron & Railroad Co. banks another furnace at Ensley, leaving only two Ensley stacks in operation. This will be the third furnace taken off within three weeks. Eleven furnaces will remain in blast in the district. The Hanna Furnace Co. has taken off its No. 2 furnace at Buffalo to conserve coke. This is a small furnace that has been running on silvery iron. The Hanna company brought 1500 tons of iron down the New York State barge canal last week, the first shipment of the season.

While there has been little export inquiry recently, one for 10,000 tons for Italy is receiving attention.

Market Sidelights

Major steel production in the country continues unaffected by the coal situation, but several mills are still in the process of earmarking reserve supplies in case the mine shutdown becomes prolonged. There has been some searching of the market recently by smaller steel plants for supplies of steam coal to run power plants. Actual inventories of coking coal are still sufficient for from two to five weeks' operations, although it is expected that blast furnace activity would be curtailed considerably before supplies were used up. Meanwhile, a shutdown of the anthracite mines would immediately cause a rush to clean up loose coke supplies around the country, since in certain instances the latter is a substitute for hard coal.

* * *

A $12,872,398 order from the U. S. War Department for a large number of the newly designed Curtiss P-40 pursuit planes has been placed with the Curtiss-Wright Corp. The planes will be constructed in the Buffalo factory of Curtiss-Wright.

* * *

The Bureau of Supplies and Accounts, Navy Department, will open bids on Thursday of the present week for 157 tons of I-beams for four destroyers, two each building at the Charleston, S. C., and Boston Navy yards.

* * *

Hardie-Tynes Mfg. Co., Birmingham, has been awarded a $225,000 contract for two valve units to be installed in the Arizona wing of Boulder Dam power plant.

* * *

An order for parts to assemble 600 electric ranges has been received by a Toledo, Ohio, manufacturer from Dunedin, New Zealand.

* * *

Large coal stocks held by a Youngstown steel company enabled the sale of several thousand tons to a hard-pressed railroad recently.

* * *

New tariff barriers against goods from the former Czechoslovakia have aided American toy makers. One company in West Virginia, which uses annually about 12,000 tons of 20-gage steel for stamping, is increasing its factory space about 65 per cent.

WAREHOUSE BUSINESS

. . . Some declines in volume last month . . . Others held to March level

WAREHOUSE business at PITTSBURGH in April totaled up to about the same volume as in March. Prices on hot rolled items continue spotty with $3 to $5 off base applying on some purely local business. The cut prices so far do not apply on orders for outlying counties.

At CLEVELAND April warehouse volume was not as good as March by about 10 per cent. Distributers expect to hold present levels throughout May. CLEVELAND reports less price trouble prevalent there than elsewhere throughout the nation.

CHICAGO jobbers report April sales about equal to those of March and expect a sidewise movement during May. Moderately good business is expected for the next two or three months even if the war talk from Europe continues. Warehouse inventories are being held to a minimum as are those of practically all consumers. Demand is well diversified.

April warehouse business in DETROIT showed declines compared with March, but prices have become fairly stabilized and the trade looks forward expectantly to initial automotive buys for 1940 models and the corresponding buys which automotive parts makers will make. A change in the quantity bracket on cold rolled carbon bars was reported for the DETROIT market area. The base price of 3.85c. per lb. remains, but on quantities of 1000 lb. or over there is no extra; 500-999 lb., 50c. extra; 300-499 lb., $1.25 extra; and 300 lb. or less, $1.50 extra.

The dollar value of warehouse sales in the NEW YORK area in April was just about equal to March, with light steel products the most active items. The demand for shapes, reinforcing bars and plates was extremely light all month. Consumers in that section continue to operate with very low inventories. Orders, while fairly numerous, involve only very small quantities. There were no important price changes in April.

BUFFALO price schedules are unchanged. Volume is holding up fairly well, with April's business being on a par with that of March. The emphasis is still on specialties, heavier lines moving slowly.

The volume of orders passing through PHILADELPHIA warehouses has shown a moderate improvement during the past fortnight, this improvement being partially of a seasonal character. All prices are unchanged from last week, although galvanized sheets continue to display weakness. In fact, galvanized material is going at such poor levels that most sellers make no effort to secure orders and only take on commitments as a service to their customers.

SHEETS AND STRIP

. . . British inquire here for 100,000 tons of corrugated sheets

THE British Government has inquired from American mills, through the Steel Export Association of America, for about 100,000 tons of corrugated galvanized sheets for air raid shelters. It is understood here that similar inquiries have been sent to Canada and Australia. No orders have been placed here as yet, but it is expected that they will be soon. The specification calls for 5-in. corrugations with regular galvanizing. There has been some discussion as to price, but it is believed that the business will be closed at about $3.25 per 100 lb.

Sheet and strip tonnage at PITTSBURGH declined further in the past week with demand at low ebb. Producers are looking for some wind-up buys

from Detroit with the possibility that initial 1940 model steel purchases may be made by the end of the month. Some "jitteriness" has appeared regarding price weakness but so far no major "incident" has occurred. It is believed that any move by one or more producers to quote less than the published base price on substantial tonnages will be met immediately by other makers. Rumors of price cuts have increased recently but most producers are checking them thoroughly before adopting any policy on meeting competitive prices. So far most rumors have proven groundless according to steel producers.

Automotive releases have gained recently, according to CLEVELAND and YOUNGSTOWN producers. A few thousand tons are believed still forthcoming from the auto industry for finishing up 1939 models. Some material for 1940 models, mostly for test purposes, has already moved from rolling mills.

Orders in the CHICAGO district were off somewhat during April and no improvement is expected until around June 1, when it is believed specifications will be received for 1940 models. The improving spring weather in the CHICAGO area over the past two weeks has resulted in some buying from culvert makers. Farm equipment demand except for tractors is slow, as dealers are well stocked and total sales are running about 25 per cent behind last year. The construction industry is fairly active in the Middle West, especially in the residential field, and a fair tonnage of roofing sheets, gutters, etc., is being received. Sales of stoves and refrigerators are fairly good in sympathy with the increased home building activity.

Moderate improvement in jobbing demand has held sheet bookings in SOUTHERN OHIO to previous levels. Automobile ordering continues to disappoint, although hopes for early production on new models raises optimistic predictions. Cold and hot-rolled material is in fair demand but heavy sheets are not encouragingly active.

April sheet volume in the NEW YORK area ran under the March totals by about 15 per cent and was made up of miscellaneous fill-in lots. It is expected that most of the larger buyers will have to enter the market before the end of the quarter as by that time they will have used up present stocks, the bulk of which represents material purchased at the low prices prevailing last October. Pressure is being exerted on all sides to place such new business on a lower price basis.

Apparently PHILADELPHIA sellers have already experienced the greater part of the current decline, as the volume of new business secured during the past week has been about on a par with that of the previous week. Galvanized sheets continue to display a poor price tone, but rumors of price weakness in autobody sheets cannot be confirmed. Perhaps such reports arose over the fact that an Ohio mill was $3 a ton under all other bidders on the 150 tons of hot rolled pickled sheets for the Federal Prison Industries, Lewisburg, Pa.

SEMI-FINISHED STEEL

. . . Major support comes from tin plate mills

BOOKINGS in the past week at PITTSBURGH were off a little from the level of the previous week. Total tonnages placed in April were about equal to March bookings. Major support, however, has come from tin bar consumers, with other buyers marking time.

Orders and shipments at CLEVELAND and YOUNGSTOWN remain very quiet. Export inquiries have been received, but due to the low prices offered, Ohio mills are reluctant to participate.

REINFORCING BARS

. . . 8000 tons for Social Security Building to Sweets Steel

NEW business continues to hold up in districts such as PITTSBURGH with projects as numerous as in late April. Sweets Steel Co., Williamsport, Pa., will furnish 8000 tons of bars for the Social Security and Railroad Retirement Building at Washington, the contractors being McCloskey & Co., while Columbia Steel Co., San Francisco, has taken a 2000-ton order from United States engineers at Los Angeles, and Joseph T. Ryerson & Son, Inc., was awarded 1640 tons for an approach to the George Washington bridge, New York.

On the WEST COAST, Bethlehem Steel Co. was awarded 2217 tons for the Grand Coulee Dam. New business includes 1700 tons for a Gary, Ind., sewage treatment plant on which the Permanent Construction Co., Chicago, is low bidder.

MERCHANT BARS

. . . April business below that of March

ALTHOUGH bar bookings at PITTSBURGH in the past week changed little in volume from the week before, total business in April averaged about 15 per cent below March orders. Diversification is fairly good but producers look for no important pick-up in demand until the general business picture clears.

CHICAGO mills do not expect much buying from makers of automobiles and automobile parts for several weeks. The main support of the market continues to be the tractor plants. Inventories are still being held to a minimum in all cases and the outlook for the next month or so is for a moderate decline which probably will not reach serious proportions.

BOLTS, NUTS AND RIVETS

. . . Some producers expect gains late this month

ALL lines during April proved poorer than March from the standpoint of orders, but some producers expect gains toward the latter part of this month. From all indications the normal fall upturn may come earlier this year, due to the automotive industry's plans. Rivet manufacturers report April showed a dip due to skimpy orders in the latter part of the month. For cap screw manufacturers April fell behind March around 10 per cent in dollar sales with automotive releases off approximately 20 per cent.

PLATES

. . . Bethlehem Steel gets 11,000-ton order at Toledo

THE largest plate order of the week was 11,000 tons for an intake line at Toledo, Ohio, placed by the contractor with the Bethlehem Steel Co. Generally, plate buying is light. In the East business has been affected somewhat by the recent bid of a Pennsylvania mill to the New York Central at $2 a ton under the regular market. This has caused other buyers to seek similar concessions. Releases from shipbuilding companies aided April shipments of some mills.

RAILROAD BUYING

. . . Denver & Rio Grande orders 550 cars, Maine Central 300

THE Denver & Rio Grande Railroad has purchased 400 box, 100 auto box, 50 65-ft. gondola cars and 100 underframes from Pressed Steel Car Co. The cars will be fabricated at Pressed Steel's McKees Rocks, Pa., plant and will require about 7000 tons of steel.

The Maine Central on Tuesday placed an order with the Bethlehem Steel Co. for 300 gondola cars. This road recently placed an order for 300 cars with Magor Car Corp.

Electro-Motive Corp. has received an order for two 2000-hp. diesel-electric locomotives from the Kansas City Southern.

The Great Northern was expected to order 10,000 tons of rails on Tuesday of this week with the proviso that an additional 10,000 tons might be bought in July.

WIRE PRODUCTS

. . . Business is slower . . . Export demands a bright spot

AGGREGATE wire sales at PITTSBURGH in April were about even with March business but somewhat below what producers had expected. Demand for merchant products and manufacturers' wire continues slow but is holding at recent activity.

CLEVELAND producers finished April with order books considerably thinner than at the start of that month. Shipments fell below March by a narrower margin. Probably the brightest spot in the wire picture is the export market, a number of fair-sized orders having been taken recently, mostly for South America. In the domestic merchant wire products field, jobbers are expected to begin refilling broken spots in their inventories during May.

Even though fairly good weather has been experienced over the middle-West in the past two weeks, CHICAGO sellers do not report much of an improvement in demand for merchant products. Temperatures have been fairly low, however, for spring and it is believed that the predicted increase will still be seen when days become warmer. Much of the industrial wire tonnage depends on the automobile industry and this buying is not expected for probably another 30 days.

STRUCTURAL STEEL

. . . Mississippi bridges head list of inquiries

BETTER weather conditions have resulted in a little more activity at CHICAGO and some other points, with awards including 1080 tons for a New York sanitation garage to American Bridge Co., 2000 tons for the Wilmot Street Bridge, Pittsburgh, to Fort Pitt Bridge Works Co., of that city, and 1200 tons for a Kansas City food market going to Mississippi Valley Steel Co., St. Louis.

Inquiries the past week were headed by two Mississippi bridges, one at Greenville to take 11,000 tons, the other at Natchez to require 9000 tons, while 1800 tons of structural steel will be required for a Navy shop extension at Boston and 1800 tons for the West Third Street Bridge at Cleveland.

The largest job in the CHICAGO area last week was an award of 800 tons for an armory. Meanwhile structural specifications at PITTSBURGH have declined slightly although April tonnage was 8 to 10 per cent ahead of March. An increase in private building projects is noted in the SAN FRANCISCO area.

TUBULAR GOODS

. . . Sales declined in April at Pittsburgh

Total tubular sales at PITTSBURGH in the past week declined from the week before. Sales in April were about 10 to 15 per cent less in volume than in March.

IRON ORE

. . . April shipments from Upper Lakes 56,798 tons

SHIPMENTS of Lake Superior iron ore from Upper Lake ports during April totaled 56,798 gross tons compared with a revised figure of 260,514 tons in April, 1938, a decrease of 78.2 per cent.

TIN PLATE

. . . Operations at 70%, a gain of five points

OPERATIONS this week are estimated at 70 per cent, up five points from last week. Heavier releases are coming from large can companies with the approach of active packing season. General line can business is holding to recent levels.

Weekly Bookings of Construction Steel

	Week Ended				Year to Date	
	May 2, 1939	Apr. 25, 1939	Apr. 4, 1938	May 3, 1938	1939	1938
Fabricated structural steel awards	11,950	19,200	20,600	21,230	350,610	240,525
Fabricated plate awards	17,470	505	4,365	500	67,185	47,390
Steel sheet piling awards	0	0	0	0	18,565	8,750
Reinforcing bar awards	19,250	4,900	5,325	2,160	160,245	76,445
Total Letting of Construction Steel..	48,670	24,605	30,290	23,890	606,605	373,110

IRON AND STEEL SCRAP

. . . Market continues soft in the absence of any real volume of mill buying . . . Composite declines 8c. nominally to $14.25, new low for 1939.

MAY 2.—Very little activity has been reported in the principal consuming centers in the past week and prices are nominally unchanged in many districts. Largely based on dealer sentiment, quoted prices to consumers at Cleveland nominally are down 50c. and in the Valley, 25c. Lower buying prices at Detroit also reflect bearish dealer sentiment. St. Louis scrap men are holding prices firm, however, in anticipation of a large sale of heavy melting steel to a district mill this week.

Chicago prices are dormant and no large scale buying is looked for in the near future. At Pittsburgh, the price of No. 1 heavy melting steel is unchanged, but at Philadelphia declining operations are taking the edge off the strong export market there. A change from a quoted flat $15.50 to a range of $15 to $15.50 for No. 1 has reduced the average price 25c. in Philadelphia, resulting in a reduction of 8c. in the composite price, from $14.33 to $14.25, establishing a new low for the year. In five weeks, the total decline has been $1.04 from the high of $15.29 of March 28. The average is now back to the figure prevailing in late September and early October.

The Japanese made their usual month-end commitment last week, but on a smaller scale than earlier in the year. Prices are unchanged. Some new European business is looked for in the near future at prevailing price levels.

Pittsburgh

With little or no activity in the past week, market conditions are substantially unchanged from a week ago. A small amount of No. 1 steel was purchased at $15 a ton and a few brokers have signified willingness to sell very small tonnages into consumption at $14.75. Quotations on No. 1 heavy melting this week remain unchanged at $14.50 to $15.

Chicago

There has been very little activity in this market over the past week. The last mill sale was at $13 and buying on these orders is between $12.50 and $12.75. With a continuing decline in operations it does not seem likely that there will be another sale to a mill for some time.

About 5000 tons of railroad heavy melting steel was sold by the Rock Island and Milwaukee roads last week for $11 net on track or $12.32 per gross ton.

Cleveland

The market here continues to decline, some of the principal grades being off 50c. per ton this week. While it is doubtful if any large tonnage would be sold to mills at present quoted levels, dealer prices are undeniably weaker. Very little scrap is moving here.

Youngstown

While the market is quoted off 25c. per ton this week, prices are purely nominal. No new business has materialized. Valley mills are taking in a little scrap under regulation.

Philadelphia

This market continues to derive its total support from export activity, without which prices would drop sharply. Despite this rather weak situation, it is still quite difficult to purchase scrap in this area, and exporters are not finding it easy to secure boat cargoes as fast as they would like. In March almost 30,000 tons of scrap left Port Richmond, and in April the tonnage was likely almost as large. One boat is loading now and another is expected in by next Monday, both for the Far East. In the domestic market, some small tonnages of specialties are moving at irregular intervals, but heavy melting grades are experiencing no demand from local mills. In fact, in view of the fair position of stocks at local mills and the poor position of steelmaking operations, it is unlikely that domestic demands will be much of a factor for several months.

Buffalo

About 10,000 tons of borings and turnings have come into Buffalo by water this week. The general tone of the market remains on the weak side, although 1000 tons of No. 1 heavy melting steel was reported sold in the district at a price ranging from $14 to $14.50 a ton. The principal consumer in the area continues to buy No. 2 bundles at prices which, applying the usual differential, would indicate a price of $13.50 to $14 for No. 1 steel.

St. Louis

The scrap iron market in St. Louis was held steady at unchanged prices because of the prospect of a sale of heavy melting steel to a district mill, which was expected to be closed during the week.

Railroad lists: Baltimore & Ohio, 6800 tons; Alton, 640 tons; St. Louis, Southwestern, 241 tons.

Cincinnati

Old materials are still in an uncertain market. European conditions are reflected here while the coal field troubles add to difficulties. Mills are taking steel grades on contract at about 40 per cent of capacity consumption, but new contracting is absent. Dealers' bids are unchanged, but nominal.

Detroit

Further price reductions became effective in Detroit during the last week when May automotive lists were closed at prices averaging 50c. per ton under previous quotations. Dealers noted with interest the fact that quantity of scrap output apparently will show further declines during the month. As previously reported, factory lists originally estimated the month's output considerably lower than last month's. After this, plants called brokers who had received lists and made further downward reductions in estimated scrap tonnages of 25 to 30 per cent. Some derive optimism from the report that the Detroit open-hearth operating rate will likely remain at its present rate of 55 per cent throughout the summer.

Boston

The withdrawal of a Weirton, W. Va., consumer of steel turnings and bundled skeleton from the market has curtailed business in scrap for domestic delivery to such an extent some brokers have practically nothing to do. However, the purchase of a round tonnage of machinery cast by a Massachusetts textile machinery manufacturer, and of trucklots by a few foundries, served to keep the market alive the past week. Export demand for scrap is keeping up well, and prices hold within a range of $13.50 to $14 a ton, delivered dock, for No. 1. During the past week, however, $14 a ton was paid less often than in the preceding week, a reflection of price concessions in the Pittsburgh district.

New York

As has been the custom for some months past, the Japanese entered the market the last week of the month, but the tonnages placed were light. Prices were in line with previous commitments. Movement of material on cars into domestic consumption continues very light, with quoted buying prices largely nominal.

Toronto

Canadian scrap markets showed little change from the preceding week. Local dealers report heavy intake of steel scrap with more extensive deliveries expected as supplies start to flow in from the more outlying areas. Most of the material reaching yards is sheet steel scrap which is being bundled. Automobile cast also is becoming more plentiful. Mills are taking heavy melting and other scrap, but have dropped contracts for delivery only about a month into the future. Despite the fact that reductions have been reported in a number of sections in the United States, local dealers state that Canadian prices are firm and they look for higher levels rather than declines.

Iron and Steel Scrap Prices

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$14.50 to $15.00
Railroad hvy. mltng...	15.50 to 16.00
No. 2 hvy. mltng. steel.	13.00 to 13.50
Scrap rails	16.00 to 16.50
Rails 3 ft. and under..	18.00 to 18.50
Comp. sheet steel	14.50 to 15.00
Hand bundled sheets..	13.50 to 14.00
Hvy. steel axle turn..	13.00 to 13.50
Machine shop turn....	9.00 to 9.50
Short shov. turn.....	10.00 to 10.50
Mixed bor. & turn.....	8.50 to 9.00
Cast iron borings	8.50 to 9.00
Cast iron carwheels...	15.00 to 15.50
Hvy. breakable cast...	12.00 to 12.50
No. 1 cupola cast.....	15.00 to 15.50
RR. knuckles & cplrs..	17.00 to 17.50
Rail coil & leaf springs	17.50 to 18.00
Rolled steel wheels....	17.50 to 18.00
Low phos. billet crops.	18.50 to 19.00
Low phos. punchings..	17.00 to 17.50
Low phos. plate	16.00 to 17.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$15.00 to $15.50
No. 2 hvy. mltng. steel.	13.00 to 13.50
Hydraulic bund., new.	$14.50 to 15.00
Hydraulic bund., old..	11.00 to 11.50
Steel rails for rolling.	17.00 to 17.50
Cast iron carwheels...	.... 16.00
Hvy. breakable cast...	15.00 to 15.50
No. 1 cast	.... 16.50
Stove plate (steel wks.)	13.00 to 13.50
Railroad malleable ...	15.50 to 16.00
Machine shop turn....	8.50 to 9.00
No. 1 blast furnace....	6.50 to 7.00
Cast borings	6.50 to 7.00
Heavy axle turnings..	10.00 to 10.50
No. 1 low phos. hvy...	17.00 to 17.50
Couplers & knuckles..	17.00 to 17.50
Rolled steel wheels....	17.00 to 17.50
Steel axles	20.00 to 20.50
Shafting	20.50 to 21.00
Spec. iron & steel pipe	12.00 to 12.50
No. 1 forge fire.....	12.00 to 12.50
Cast borings (chem.)..	9.50 to 10.00

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy. mltng. steel	$12.50 to $13.00
Auto. hvy. mltng. steel alloy free	11.25 to 11.75
No. 2 auto steel	10.50 to 11.00
Shoveling steel	12.50 to 13.00
Factory bundles	11.75 to 12.25
Dealers' bundles	10.75 to 11.25
Drop forge flashings...	9.25 to 9.75
No. 1 busheling	11.25 to 11.75
No. 2 busheling, old...	5.25 to 5.75
Rolled carwheels	14.50 to 15.00
Railroad tires, cut ...	14.50 to 15.00
Railroad leaf springs..	14.50 to 15.00
Steel coup. & knuckles	14.50 to 15.00
Axle turnings	11.50 to 12.00
Coil springs	16.00 to 16.50
Axle turn. (elec.).....	13.00 to 13.50
Low phos. punchings..	15.50 to 16.00
Low phos. plates 12 in. and under	15.00 to 15.50
Cast iron borings	5.50 to 6.00
Short shov. turn.....	6.00 to 6.50
Machine shop turn....	6.00 to 6.50
Rerolling rails	16.50 to 17.00
Steel rails under 3 ft..	15.50 to 16.00
Steel rails under 2 ft..	16.00 to 16.50
Angle bars, steel	15.00 to 15.50
Cast iron carwheels ...	12.25 to 12.75
Railroad malleable	14.50 to 15.00
Agric. malleable	10.75 to 11.25

	Per Net Ton
Iron car axles	$18.00 to $18.50
Steel car axles	17.50 to 18.00
Locomotive tires	13.00 to 13.50
Pipes and flues	8.50 to 9.00
No. 1 machinery cast.	11.50 to 12.00
Clean auto. cast	12.50 to 13.00
No. 1 railroad cast....	10.50 to 11.00
No. 1 agric. cast	10.00 to 10.50
Stove plate	7.25 to 7.75
Grate bars	7.75 to 8.25
Brake shoes	9.00 to 9.50

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$14.25 to $14.75
No. 2 hvy. mltng. steel.	13.25 to 13.75
Low phos. plate	15.25 to 15.75
No. 1 busheling	13.50 to 14.00
Hydraulic bundles	13.75 to 14.25
Machine shop turn....	8.75 to 9.25

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$13.00 to $13.50
No. 2 hvy. mltng. steel	12.00 to 12.50
Comp. sheet steel	12.50 to 13.00
Light bund. stampings	9.50 to 10.00
Drop forge flashings..	11.00 to 11.50
Machine shop turn....	7.00 to 7.50
Short shov. turn.....	7.50 to 8.00
No. 1 busheling	12.50 to 13.00
Steel axle turnings....	10.50 to 11.00
Low phos. billet and bloom crops	17.50 to 18.00
Cast iron borings	7.50 to 8.00
Mixed bor. & turn....	7.50 to 8.00
No. 2 busheling	7.50 to 8.00
No. 1 cupola cast	14.50 to 15.00
Railroad grate bars ..	8.50 to 9.00
Stove plate	9.00 to 9.50
Rails under 3 ft.	17.25 to 17.75
Rails for rolling	17.50 to 18.00
Railroad malleable	14.50 to 15.00
Cast iron carwheels ..	13.50 to 14.00

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$13.50 to $14.00
No. 2 hvy. mltng. steel.	11.50 to 12.00
Scrap rails	15.00 to 15.50
New hvy. b'ndled sheets	11.50 to 12.00
Old hydraul. bundles..	10.25 to 10.75
Drop forge flashings...	11.50 to 12.00
No. 1 busheling	11.50 to 12.00
Hvy. axle turnings....	9.50 to 10.00
Machine shop turn....	6.50 to 7.00
Knuckles & couplers..	16.50 to 17.00
Coil & leaf springs....	16.50 to 17.00
Rolled steel wheels....	16.00 to 16.50
Low phos. billet crops.	15.50 to 16.00
Shov. turnings	7.50 to 8.00
Mixed bor. & turn....	6.75 to 7.25
Cast iron borings	6.75 to 7.25
Steel car axles	16.50 to 17.00
No. 1 machinery cast..	15.00 to 16.00
No. 1 cupola cast.	14.50 to 15.00
Stove plate	13.00 to 13.50
Steel rails under 3 ft..	18.00 to 18.50
Cast iron carwheels...	13.50 to 14.00
Railroad malleable	15.00 to 15.50
Chemical borings	9.00 to 9.50

ST. LOUIS

Dealers' buying prices per gross ton delivered to consumer:

Selected hvy. melting.	$12.00 to $12.50
No. 1 hvy. melting....	11.50 to 12.00
No. 2 hvy. melting....	10.75 to 11.25
No. 1 locomotive tires.	12.25 to 12.75
Misc. stand. sec. rails.	13.00 to 13.50
Railroad springs	14.00 to 14.50
Bundled sheets	7.00 to 7.50
No. 1 busheling	7.50 to 8.00
Cast. bor. & turn.....	2.50 to 3.00
Machine shop turn....	3.50 to 4.00
Heavy turnings	9.00 to 9.50
Rails for rolling	16.00 to 16.50
Steel car axles	17.00 to 17.50
No. 1 RR. wrought....	10.25 to 10.75
No. 2 RR. wrought....	11.50 to 12.00
Steel rails under 3 ft..	16.00 to 16.50
Steel angle bars	13.00 to 13.50
Cast iron carwheels...	14.00 to 14.50
No. 1 machinery cast..	12.00 to 12.50
Railroad malleable ...	12.25 to 12.75
No. 1 railroad cast....	12.00 to 12.50
Stove plate	7.50 to 8.00
Grate bars	8.50 to 9.00
Brake shoes	9.50 to 10.00

CINCINNATI

Dealers' buying prices per gross ton at yards:

No. 1 hvy. mltng. steel.	$10.75 to $11.25
No. 2 hvy. mltng. steel.	8.50 to 9.00
Scrap rails for mltng.	14.25 to 14.75
Loose sheet clippings.	6.25 to 6.75
Hydrau. b'ndled sheets	10.50 to 11.00
Cast iron boring	2.75 to 3.25
Machine shop turn....	4.25 to 4.75
No. 1 busheling	6.75 to 7.25
No. 2 busheling	1.75 to 2.25
Rails for rolling	16.25 to 16.75
No. 1 locomotive tires.	13.00 to 13.50
Short rails	17.00 to 17.50
Cast iron carwheels...	12.00 to 12.50
No. 1 machinery cast..	12.75 to 13.25
No. 1 railroad cast....	11.50 to 12.00
Burnt cast	5.75 to 6.25
Stove plate	5.75 to 6.25
Agricul. malleable	10.50 to 11.00
Railroad malleable	13.00 to 13.50
Mixed hvy. cast	9.75 to 10.25

BIRMINGHAM

Per gross ton delivered to consumer:

Hvy. melting steel....	$12.50 to $14.00
Scrap steel rails	14.50 to 15.00
Short shov. turnings..	7.50 to 8.10
Stove plate	9.00 to 10.00
Steel axles	15.00 to 16.00
Iron axles	15.00 to 16.00
No. 1 RR, wrought	.... 10.00
Rails for rolling	16.00 to 16.50
No. 1 cast	.... 14.50
Tramcar wheels	.... 14.00

DETROIT

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. industrial steel	$9.50 to $10.00
No. 2 hvy. mltng. steel.	8.50 to 9.00
Borings and turnings..	4.75 to 5.25
Long turnings	4.75 to 5.25
Short shov. turnings..	5.50 to 6.00
No. 1 machinery cast..	12.50 to 13.00
Automotive cast	13.00 to 13.50
Hvy. breakable cast...	9.00 to 9.50
Stove plate	7.50 to 8.00
Hydraul. comp. sheets.	10.50 to 11.00
New factory bushel....	9.50 to 10.00
Sheet clippings	6.75 to 7.75
Flashings	9.00 to 9.50
Low phos. plate scrap.	10.50 to 11.00

NEW YORK

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$11.00 to $11.50
No. 2 hvy. mltng. steel.	9.00 to 9.50
Hvy. breakable cast...	10.50 to 11.00
No. 1 machinery cast.	11.50 to 12.00
No. 2 cast	9.50 to 10.00
Stove plate	9.50 to 10.00
Steel car axles	20.00 to 20.50
Shafting	15.50 to 16.00
No. 1 RR, wrought....	11.00 to 11.50
No. 1 wrought long....	9.50 to 10.00
Spec. iron & steel pipe	9.00 to 9.50
Rails for rolling	16.00 to 16.50
Clean steel turnings*..	4.00 to 4.50
Cast borings*	3.50 to 4.00
No. 1 blast furnace....	3.50 to 4.00
Cast borings (chem.)..	9.50 to 10.00
Unprepared yard scrap	6.00 to 6.50
Light iron	3.00 to 3.50
Per gross ton, delivered local foundries:	
No. 1 machn. cast†....	$13.50 to $14.00
No. 2 cast†	10.50 to 11.00

* $1.50 less for truck loads.
† Northern N. J. prices are $2 to $2.50 higher

BOSTON

Dealers' buying prices per gross ton:

Breakable cast	$9.65
Machine shop turn....	$3.38 to $4.15
Mixed bor. & turn....	2.00 to 2.25
Bun. skeleton long.....	.... 7.90
Shafting	.... 15.75
Cast bor. chemical....	4.50 to 5.00
Per gross ton delivered consumers' yards:	
Textile cast	$12.50 to $14.00
No. 1 machine cast....	12.50 to 14.00
Per gross ton delivered dealers' yards:	
No. 1 hvy. mltng. steel.	$11.25 to $11.50
No. 2 steel	10.00 to 10.25

PACIFIC COAST

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel.	$12.00 to $13.00
No. 2 hvy. mltng. steel.	11.00 to 12.00

CANADA

Dealers' buying prices at their yards, per gross ton:

	Toronto	Montreal
No. 1 hvy. mltng. steel.	$10.00	$9.50
No. 2 hvy. mltng. steel.	8.50	8.00
Mixed dealers steel....	7.25	6.75
Drop forge flashings...	9.25	8.75
New loose clippings...	4.75	4.25
Busheling	4.50	4.00
Scrap pipe	5.75	5.25
Steel turnings	5.25	4.75
Cast borings	4.00	3.50
Machinery cast	15.25	14.25
Dealers cast	13.25	12.25
Stove plate	11.25	10.25

EXPORT

Dealers' buying prices per gross ton:

New York, truck lots, delivered, barges

No. 1 hvy. mltng. steel.	$12.00 to $12.50
No. 2 hvy. mltng. steel.	10.50 to 11.00
No. 2 cast	10.50 to 11.00
Stove plate	9.50 to 10.00

Boston on cars at Army Base or Mystic Wharf

No. 1 hvy. mltng. steel.	$13.50 to $14.00
No. 2 hvy. mltng. steel.	12.50 to 12.75
Rails (scrap)	13.50 to 14.00
Mixed textile and machinery cast	12.00

Philadelphia, delivered alongside boats, Port Richmond

No. 1 hvy. mltng. steel.	$15.00 to $15.25
No. 2 hvy. mltng. steel.	13.50 to 13.75

PRICES ON FINISHED AND SEMI-FINISHED IRON AND STEEL

Steel prices on these pages are base prices only and f.o.b. mill unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases the amount of freight which must be absorbed in order to meet competition.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (Rerolling only). Prices delivered Detroit are $2 higher. F.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Gross Ton
Pittsburgh, Chicago or Cleveland	$43.00
Worcester, Mass.	45.00
Birmingham	43.00
San Francisco	52.00

Rods over 9/32 in. or 47/64 in., inclusive, $5 a ton over base.

SOFT STEEL BARS

	Base per Lb.
Pittsburgh, Chicago, Gary, Cleveland, Buffalo and Birmingham	2.25c.
Detroit, delivered	2.35c.
Duluth	2.35c.
Philadelphia, delivered	2.57c.
New York	2.59c.
On cars dock Gulf ports	2.60c.
On cars dock Pacific ports	2.85c.

RAIL STEEL BARS

(For merchant trade)

Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham	2.10c.
On cars dock Tex. Gulf ports	2.45c.
On cars dock Pacific ports	2.70c.

BILLET STEEL REINFORCING BARS

(Straight lengths as quoted by distributers)

Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Cleveland, Youngstown or Sparrows Pt.	1.90c. to 2.05c.
Detroit, delivered	2.00c. to 2.15c.
On cars dock Tex. Gulf ports	2.25c. to 2.40c.
On cars dock Pacific ports	2.50c.

RAIL STEEL REINFORCING BARS

(Straight lengths as quoted by distributers)

Pittsburgh, Chicago, Gary, Buffalo, Cleveland, Youngstown or Birmingham	1.75c. to 1.90c.
Detroit, delivered	1.85c. to 2.00c.
On cars dock Tex. Gulf ports	2.10c. to 2.25c.
On cars dock Pacific ports	2.35c.

Prices on reinforcing bars have been subject to concessions of $3 a ton or more from above quotations.

IRON BARS

Chicago and Terre Haute	2.15c.
Pittsburgh (refined)	3.60c.

COLD FINISHED BARS AND SHAFTING*

	Base per Lb.
Pittsburgh, Buffalo, Cleveland, Chicago and Gary	2.70c.
Detroit	2.75c.

* In quantities of 10,000 to 19,999 lb.

PLATES

	Base per Lb.
Pittsburgh, Chicago, Gary, Birmingham, Sparrows Point, Cleveland, Youngstown, Coatesville, Claymont, Del.	2.10c.
Philadelphia, del'd	2.15c.
New York, del'd	2.29c.
On cars dock Gulf ports	2.45c.
On cars dock Pacific ports	2.60c.
Wrought iron plates, P'tg.	3.80c.

FLOOR PLATES

Pittsburgh or Chicago	3.35c.
New York, del'd	3.71c.
On cars dock Gulf ports	3.70c.
On cars dock Pacific ports	3.95c.

STRUCTURAL SHAPES

	Base per Lb.
Pittsburgh, Chicago, Gary, Buffalo, Bethlehem or Birmingham	2.10c.
Philadelphia, del'd	2.215c.
New York, del'd	2.27c.
On cars dock Gulf ports	2.45c.
On cars dock Pacific ports	2.70c.

STEEL SHEET PILING

	Base per Lb.
Pittsburgh, Chicago or Buffalo	2.40c.
On cars dock Gulf ports	2.85c.
On cars dock Pacific ports	2.90c.

RAILS AND TRACK SUPPLIES

F.o.b. Mill

Standard rails, heavier than 60 lb., per gross ton	$40.00
Angle bars, per 100 lb.	2.70

F.o.b. Basing Points

Light rails (from billets) per gross ton	$40.00
Light rails (from rail steel) per gross ton	39.00

	Base per Lb.
Cut spikes	3.00c.
Screw spikes	4.55c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast ports	2.25c.
Track bolts, to steam railroads	4.15c.
Track bolts to jobbers, all sizes (per 100 counts)	65-5

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa., Buffalo; on spikes alone, Youngstown, Lebanon, Pa., Richmond, Va.

SHEETS

Hot Rolled

	Base per Lb.
Pittsburgh, Gary, Birmingham, Buffalo, Sparrows Point, Cleveland, Youngstown, Middletown or Chicago	2.15c.
Detroit, delivered	2.25c.
Philadelphia, delivered	2.32c.
Granite City	2.25c.
On cars dock Pacific ports	2.65c.
Wrought iron, Pittsburgh	4.25c.

Cold Rolled*

Pittsburgh, Gary, Buffalo, Youngstown, Cleveland, Middletown or Chicago	3.20c.
Detroit, delivered	3.30c.
Granite City	3.30c.
Philadelphia, delivered	3.52c.
On cars dock Pacific ports	3.80c.

* Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base.

Galvanized Sheets, 24 Gage

Pittsburgh, Chicago, Gary Sparrows Point, Buffalo, Middletown, Youngstown or Birmingham	3.50c.
Philadelphia, delv'd	3.67c.
Granite City	3.60c.
On cars dock Pacific ports	4.00c.
Wrought iron Pittsburgh	6.10c.

Electrical Sheets

(*F.o.b. Pittsburgh*)

	Base per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon Strip in coils—Sheet prices plus silicon sheet extra width extra plus 25c per 100 lb. for coils. Pacific ports add 70c. a 100 lb.

Long Ternes

No. 24 unassorted 8-lb. coating f.o.b. Pittsburgh or Gary	3.95c.
F.o.b. cars dock Pacific ports	4.65c.

Vitreous Enameling Stock, 20 Gage*

Pittsburgh, Chicago, Gary, Youngstown, Middletown or Cleveland	3.35c.
Detroit, delv'd	3.45c.
Granite City	3.45c.
On cars dock Pacific ports	3.95c.

TIN MILL PRODUCTS

***Tin Plate**

	Per Base Box
Standard cokes, Pittsburgh, Chicago and Gary	$5.00
Standard cokes, Granite City	5.10

* Prices effective Nov. 10 on shipments through first quarter of 1939.

Special Coated Manufacturing Ternes

	Per Base Box
Granite City	$4.40
Pittsburgh or Gary	4.30

Roofing Terne Plate

(*F.o.b. Pittsburgh*)

(Per Package, 112 sheets, 20 x 28 in.)	
8-lb. coating I.C.	$12.00
15-lb. coating I.C.	14.00
20-lb. coating I.C.	15.00
25-lb. coating I.C.	16.00
30-lb. coating I.C.	17.25
40-lb. coating I.C.	19.50

Black Plate, 29 gage and lighter

Pittsburgh, Chicago and Gary	3.05c.
Granite City	3.15c.
On cars dock Pacific ports, boxed	4.00c.

HOT ROLLED STRIP

(*Widths up to 12 in.*)

	Base per Lb.
Pittsburgh, Chicago, Gary, Cleveland, Middletown, Youngstown or Birmingham	2.15c.
Detroit, delivered	2.25c.

Cooperage Stock

Pittsburgh & Chicago	2.25c.

COLD ROLLED STRIP*

	Base per Lb.
Pittsburgh, Youngstown or Cleveland	2.95c.
Chicago	3.05c.
Detroit, delivered	3.05c.
Worcester	3.15c.

* Carbon 0.25 and less.

Commodity Cold Rolled Strip

Pittsburgh, Youngstown, or Cleveland	3.10c.
Detroit, delivered	3.20c.
Worcester	3.50c.

COLD ROLLED SPRING STEEL

		Pittsburgh and Cleveland	Worcester
Carbon	0.26-0.50%	2.95c.	3.15c.
Carbon	0.51-0.75	4.30c.	4.50c.
Carbon	0.76-1.00	6.15c.	6.35c.
Carbon	1.01-1.25	8.35c.	8.55c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh, Chicago, Cleveland and Birmingham)

To Manufacturing Trade

	Per Lb.
Bright wire	2.60c.
Galvanized wire, base	2.65c.*
Spring wire	3.20c.

* On galvanizing wire to manufacturing trade, size and galvanizing extras are charged, the price Nos. 6 to 9 gage, inclusive, thus being 3.15c.

To the Trade

	Base per Keg
Standard wire nails	$2.45
Coated nails	2.45
Cut nails, carloads	3.60

	Base per 100 Lb.
Annealed fence wire	$2.95
Galvanized fence wire	3.35
Polished staples	3.15
Galvanized staples	3.40
Twisted barbless wire	3.30
Woven wire fence, base column.	67
Single loop bale ties, base col...	56
Stand. 2 pt., 12.5 gage barbed cattle wire, per 80 rod spool...	$2.62
Stand. 2 pt., 12.5 gage barbed hog wire, per 80 rod spool....	$2.80

Note: Birmingham base same on above items, except spring wire.

Add $4 a ton for Mobile, Ala.; $5 for New Orleans; $6 for Lake Charles to above bases, except on galvanized and annealed merchant fence wire, which are $1 a ton additional in each case.

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel			*Wrought Iron*		
In.	Black	Galv.	In.	Black	Galv.
⅛	56	36	¼ & ⅜	..+9	+30
¼ to ⅜	.59	43½	½	24	6½
½	.....63½	54	¾	30	13
¾	.....66½	58	1 & 1¼	.34	19
1 to 3	...68½	60½	1½	38	21½
			2	.....37½	21

Lap Weld

2	61	52½	2	.....30½	15
2½ & 3	..64	55½	2½ to 3½	31½	17½
3½ to 6.66		57½	4	.....33½	21
7 & 8.65		55½	4½ to 8.32	1½	20
9 & 10.64	1½	55	9 to 12	..28½	15
11 & 12.63	1½	54			

Butt weld, extra strong, plain ends

⅛	.....54½	41½	¼ & ⅜	.+10	+43
½ to ⅞	.56½	45½	½	25	9
½	.....61½	37½	¾	31	15
¾	.....65½	57½	1 to 2	...38	22½
1 to 3	...67	60			

Lap weld, extra strong, plain ends

2	59	51½	2	.....33½	18½
2½ & 3	..63	55½	2½ to 4.39	1½	25⅛
3½ to 6.66	1½	59	4½ to 6.37	1½	24
7 & 8.65	1½	56	7 & 8	..38	24½
9 & 10.64	1½	55	9 to 12	..32	20½
11 & 12.63	1½	54			

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher, on all butt weld 8 in. and smaller.

Boiler Tubes

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes. Minimum Wall.

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld Hot Rolled
1 in. o.d....13 B.W.G.	$ 9.01	$ 7.82	....
1¼ in. o.d...13 B.W.G.	10.67	9.26	....
1½ in. o.d...13 B.W.G.	11.70	10.23	$9.72
1¾ in. o.d...13 B.W.G.	13.42	11.64	11.06
2 in. o.d.....13 B.W.G.	15.03	13.04	12.38
2¼ in. o.d...13 B.W.G.	16.76	14.54	13.79
2½ in. o.d...12 B.W.G.	18.45	16.01	15.16
2½ in. o.d...12 B.W.G.	20.21	17.54	16.58
2¾ in. o.d...12 B.W.G.	21.42	18.59	17.54
3 in. o.d.....12 B.W.G.	22.48	19.50	18.35
3½ in. o.d...11 B.W.G.	28.37	24.62	23.15
4 in. o.d.....10 B.W.G.	35.20	30.54	28.66
4½ in o.d...10 B.W.G.	43.04	37.35	35.22
5 in. o.d..... 9 B.W.G.	54.01	46.87	44.25
6 in. o.d..... 7 B.W.G.	82.93	71.96	68.14

Extras for less carload quantities:

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

CAST IRON WATER PIPE

	Per Net Ton
*6-in. and larger, del'd Chicago.	$51.00
6-in. and larger, del'd New York	49.00
*6-in. and larger, Birmingham.	43.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles....	52.00
F.o.b. dock, Seattle	52.00
4-in. f.o.b. dock, San Francisco or Los Angeles	55.00
F.o.b. dock, Seattle	52.00

Class "A" and gas pipe, $3 extra 4-in. pipe is $3 a ton above 6-in.

Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $42, Birmingham, and $50 delivered Chicago and 4-in. pipe, $45, Birmingham, and $54 delivered Chicago.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland Birmingham or Chicago)

	Per Cent Off List
Machine and carriage bolts:	
½ in. & 6 in. and smaller....	68½
Larger and longer up to 1 in..	66
1⅛ in. and larger	64
Lag bolts	66
Plow bolts, Nos. 1, 2, 3 and 7	68½
Hot pressed nuts, and c.p.c. and t-nuts, square or hex. blank or tapped:	
½ in. and smaller	67
9/16 in. to 1 in. inclusive.....	64
1⅛ in. and larger	62

On the above items with the exception of plow bolts, there is an additional allowance of 10 per cent for full container quantities.

On all of the above items, there is an additional 5 per cent allowance for carload shipments.

	U.S.S.	S.A.E.
Semi-fin. hexagon nuts ½ in. and smaller	67	70
9/16 to 1 in.	64	65
1⅛ in. and larger	62	62

In full container lots, 10 per cent additional discount.

Stove bolts in packages, nuts attached	72½
Stove bolts in packages, with nuts separate	72½ and 12½
Stove bolts in bulk	84

On stove bolts freight is allowed to destination on 200 lb. and over.

Large Rivets

(½ in. and larger)

	Base Per 100 Lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.40

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland Chicago, Birmingham	65 and 10

Cap and Set Screws

(Freight allowed to destination)

	Per Cent Off List
Milled hexagon head, cap screws, 1 in. dia. and smaller	50 and 10
Milled headless set screws, cut thread ¾ in. and smaller	70
Upset hex. head cap screws U.S.S. or S.A.E. thread 1 in. and smaller	67½
Upset set screws, cup and oval points	75
Milled studs	60

Alloy and Stainless Steel

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Base price, $56.00 a gross ton.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton. Open-hearth grade, base 2.80c. Delivered, Detroit 2.90c.

S.A.E. Series Numbers	Alloy Differential per 100 Lb.
2100 (1½% Nickel)	$0.75
2300 (3½% Nickel)	1.55
2500 (5% Nickel)	2.25
3100 Nickel-chromium	0.70
3200 Nickel-chromium	1.85
3300 Nickel-chromium	3.80
3400 Nickel-chromium	3.20
4100 Chromium-molybdenum (0.15 to 0.25 Molybdenum)	0.55
4100 Chromium-molybdenum (0.25 to 0.40 Molybdenum)	0.75
4600 Nickel - molybdenum (0.20 to 0.30 Mo. 1.50 to 2.00 Ni.)	1.10
5100 Chrome steel (0.60-0.90 Cr.)	0.35
5100 Chrome steel (0.80-1.10 Cr.)	0.45
5100 Chromium spring steel	0.15
6100 Chromium-vanadium bar..	1.20
6100 Chromium-vanadium spring steel	0.35
Chromium-nickel vanadium	1.50
Carbon-vanadium	0.85

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.40c. base per lb. Delivered Detroit, 3.50c., carlots.

CORROSION & HEAT RESISTANT ALLOYS

(Base prices, cents per lb., f.o.b. Pittsburgh)

Chrome-Nickel

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25c.	24c.
Plates	29c.	27c.
Structural shapes..	25c.	24c.
Sheets	36c.	34c.
Hot-rolled strip	23.50c.	21.50c.
Cold-rolled strip	30c.	28c.
Drawn wire	25c.	24c.

Straight Chrome

	No. 410	No. 430	No. 442	No. 446
Bars	18.50c.	19c.	22.50c.	27.50c.
Plates	21.50c.	22c.	25.50c.	30.50c.
Sheets	26.50c.	29c.	32.50c.	36.50c.
Hot Strip	17c.	17.50c.	23c.	28c.
Cold stp.	22c.	22.50c.	28.50c.	36.50c.

TOOL STEEL

High speed	67c.
High-carbon-chrome	43c.
Oil-hardening	24c.
Special	22c.
Extra	18c.
Regular	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

British and Continental

BRITISH

Per Gross Ton
f.o.b. United Kingdom Ports

Ferromanganese, export	Nominal
Tin plate, per base box	20s. 3d.
Steel bars, open hearth	£10 8s.
Beams, open-hearth	£10
Channels, open hearth	£10 5s.
Angles, open-hearth	£10
Black sheets, No. 24 gage.	£13
Galvanized sheets, No. 24 gage	£15 15s.

CONTINENTAL

Per Gross Ton, Gold £, f.o.b. Continental Ports

Billets, Thomas	Nominal
Wire rods, No. 5 B.W.G.	£5 10s.
Steel bars, merchant	£5 5s.
Sheet Bars	Nominal
Plate ¼ in. and up	£5 7s.
Plate 3/16 in. and 5 mm.	£5 13s.
Sheets ⅛ in.	£5 9s. 6d.
Beams, Thomas	£4 18s.
Angles (Basic)	£4 13s.
Hoops and strip, base	£5 12s.

RAW MATERIALS PRICES

PIG IRON

No. 2 Foundry

F.o.b. Everett, Mass.	$22.00
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa., and Sparrows Point, Md.	22.00
Delivered Brooklyn	24.50
Delivered Newark or Jersey City	23.53
Delivered Philadelphia	22.84
F.o.b. Neville Island, Erie, Pa., Toledo, Chicago, Granite City, Cleveland and Youngstown	21.00
F.o.b. Buffalo	21.00
F.o.b. Detroit	21.00
Southern, delivered Cincinnati	21.06
Northern, delivered, Cincinnati	21.44
F.o.b. Duluth	21.50
F.o.b. Provo, Utah	19.00
Delivered, San Francisco, Los Angeles or Seattle	24.50
F.o.b. Birmingham*	17.38

* Delivered prices on southern iron for shipment to northern points are 38c. a ton below delivered prices from nearest northern basing point on iron with phosphorus content of 0.70 per cent and over.

Malleable

Base prices on malleable iron are 50c. a ton above No. 2 foundry quotations at Everett, Eastern Pennsylvania furnaces, Erie and Buffalo. Elsewhere they are the same, except at Birmingham and Provo, which are not malleable iron basing points.

Basic

F.o.b. Everett, Mass.	$21.50
F.o.b. Bethlehem, Birdsboro, Swedeland and Steelton, Pa., and Sparrows Point, Md.	21.50
F.o.b. Buffalo	20.00
F.o.b. Neville Island, Erie, Pa., Toledo, Chicago, Granite City, Cleveland and Youngstown	20.50
Delivered Philadelphia	22.34
Delivered Canton, Ohio	21.89
Delivered Mansfield, Ohio	22.44
F.o.b. Birmingham	16.00

Bessemer

F.o.b. Buffalo	$22.00
F.o.b. Everett, Mass.	23.00
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa.	23.00
Delivered Newark or Jersey City	24.53
Erie, Pa., and Duluth	22.00
F.o.b. Neville Island, Toledo, Chicago and Youngstown	21.50
F.o.b. Birmingham	22.00
Delivered Cincinnati	22.11
Delivered Canton, Ohio	22.89
Delivered Mansfield, Ohio	23.44

Low Phosphorus

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.	26.50

Gray Forge

Valley or Pittsburgh furnace	$20.50

Charcoal

Lake Superior furnace	$25.00
Delivered Chicago	28.34

Canadian Pig Iron

Per Gross Ton

Montreal	
Foundry Iron	$24.50 base
Malleable	25.00 base
Basic	24.50 base

Toronto	
Foundry iron	$22.50 base
Malleable	23.00 base
Basic	22.50 base

On all grades 2.25 per cent silicon and under is base. For each 25 points of silicon over 2.25 per cent an extra of $5c. is charged.

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload) $80.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%	$28.00
Domestic, 26 to 28%	33.00

Electric Ferrosilicon

Per Gross Ton Delivered; Lump Size

50% (carload lots, bulk)	$69.50*
50% (ton lots in 50 gal. bbl.)	80.50*
75% (carload lots, bulk)	126.00*
75% (ton lots in 50 gal. bbl.)	139.00*

Bessemer Ferrosilicon

F.o.b. Furnace, Jackson, Ohio
Per Gross Ton

10.00 to 10.50% $30.50

For each additional 0.50% silicon up to 12%, 50c. per ton is added. Above 12% add 75c. per ton.

For each unit of maganese over 2%, $1 per ton additional. Phosphorus 0.75% or over, $1 per ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Silvery Iron

Per Gross Ton

F.o.b. Jackson, Ohio, 5.00 to 5.50% $24.50

For each additional 0.5% silicon up to 12%, 50c. a ton is added. Above 12% add 75c. a ton.

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Ferrochrome

Per Lb. Contained Cr., Delivered Carlots, Lump Size, on Contract

4 to 6% carbon	10.50c.*
2% carbon	16.50c.*
1% carbon	17.50c.*
0.10% carbon	19.50c.*
0.06% carbon	20.00c.*

Silico-Manganese

Per Gross Ton, Delivered, Lump Size, Bulk, on Contract

3% carbon	$83.00
2.50% carbon	88.00
2% carbon	93.00
1% carbon	103.00

Other Ferroalloys

Ferrotungsten, per lb. contained W del., carloads	$1.75
Ferrotungsten, 100 lbs. and less	2.00
Ferrovanadium, contract, per lb. contained V., delivered	$2.70 to $2.90†
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y., tons lots	$2.25†
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace carload and contract per net ton	$142.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton	$157.50
Ferrophosphorus, electric, or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, electrolytic, 23-26% in car lots, f.o.b. Monsanto (Siglo), Tenn., 24%, per gross ton, $3 unitage, freight equalized with Nashville	$75.00
Ferromolybdenum, per lb. Mo. f.o.b. furnace	95c.
Calcium molybdate, per lb. Mo. f.o.b. furnace	80c.
Molybdenum oxide briquettes 48-52% Mo; per lb. contained Mo, f.o.b. Langeloth, Pa.	80c.

* Spot prices are $5 per ton higher.
† Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores

Delivered Lower Lake Ports
Per Gross Ton

Old range, Bessemer, 51.50%	$5.25
Old range, non-Bessemer, 51.50%	5.10
Messabi, Bessemer, 51.50%	5.10
Messabi, non-Bessemer, 51.50%	4.95
High phosphorus, 51.50%	4.85

Foreign Ore

C.i.f. Philadelphia or Baltimore
Per Unit

Iron, low phos., copper free, 55 to 58% dry, Algeria	12c.
Iron, low phos., Swedish, average, 68½% iron	12c.
Iron, basic or foundry, Swedish, aver. 65% iron	11c.
Iron, basic or foundry, Russian, aver. 65% iron	Nominal
Man., Caucasian, washed 52%	29c.
Man., African, Indian, 44-48%	25c.
Man., African, Indian, 49-51%	28c.
Man., Brazilian, 46 to 48%	27c

Per Short Ton Unit

Tungsten, Chinese, Wolframite, duty paid, delivered	$19.25
Tungsten, domestic, scheelite delivered	$16.00 to $18.00
Chrome or (lump) c.i.f. Atlantic Seaboard, per gross ton: South African (low grade)	$15.00
Rhodesian, 45%	19.00
Rhodesian, 48%	22.50
Turkish, 48-49%	22.50
Turkish, 45-46%	19.00
Turkish, 40-44%	17.00
Chrome concentrates (Turkish) c.i.f. Atlantic Seaboard, per gross ton: 50%	$25.00
48-49%	23.50

FLUORSPAR

Per Net Ton

Domestic washed gravel, 85-5, f.o.b. Kentucky and Illinois mines, all rail	$17.00 to $18.00
Domestic, f.o.b. Ohio River landing barges	18.00
No. 2 lump, 85-5, f.o.b. Kentucky and Ill. mines	18.00
Foreign, 85% calcium, fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	21.50
Domestic No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	31.50

FUEL OIL

Per Gal.

No. 2, f.o.b. Bayonne	3.75c.
No. 6, f.o.b. Bayonne	2.26c.
No. 5 Bur. Stds., del'd Chicago	3.25c.
No. 6 Bur. Stds., del'd Chicago	2.75c.
No. 3 distillate, del'd Cleve'd.	5.50c.
No. 4 industrial, del'd Cleve'd.	5.25c.
No. 5 industrial, del'd Cleve'd.	3.00c.
No. 6 industrial, del'd Cleve'd.	2.75c.

COKE

Per Net Ton

Furnace, f.o.b. Connellsville, Prompt	$3.75
Furnace, f.o.b. Connellsville, Prompt	$4.75 to 5.50
Foundry, by - product, Chicago ovens	10.25
Foundry, by - product, del'd New England	12.50
Foundry, by - product, del'd Newark or Jersey City	10.88 to 11.40
Foundry, by - product, Philadelphia	10.95
Foundry, by - product, delivered Cleveland	10.30
Foundry, by - product, delivered Cincinnati	9.75
Foundry, Birmingham	7.50
Foundry, by - product, del'd St. Louis industrial district	10.75 to 11.00
Foundry, from Birmingham, f.o.b. cars dock Pacific ports	14.75

IRON AND STEEL WAREHOUSE PRICES

PITTSBURGH*

	Base per Lb.
***Plates	3.55c.
***Shapes	3.55c.
***Soft steel bars and small shapes	3.60c.
***Reinforcing steel bars	2.70c.
stock	3.70c.
Cold finished bars and screw stock	3.70c.
***Hot rolled strip	3.75c.
***Hot rolled sheets	3.50c.
Galv. sheets (24 ga.) 500 lb. to 1499 lb.	4.50c.
Wire, black, soft annealed	3.15c.
Wire, galv., soft	3.55c.
Track spikes (1 to 24 kegs)	3.60c.
Wire nails (in 100-lb kegs)	2.65c.

On plates, structurals, bars, strip and hot rolled sheets, base applied to orders of 400 to 1999 lb.
** On reinforcing bars base applies to orders of less than one ton and includes switching and carting charge.
* All above prices for delivery within the Pittsburgh switching district.
*** For the time being, these prices are purely nominal as concessions ranging from $3 to $5 a ton on these products have been made recently on local sales.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.76c.
Structural shapes	3.75c.
Soft steel bars, round	3.94c.
Iron bars, Swed. charcoal	7.50 to 8.25c.
Cold-fin, shafting and screw stock:	
Rounds, squares, hexagons	4.14c.
Flats up to 12 in. wide	4.14c.
Cold-rolled strip, soft and quarter hard	3.66c.
Hot-rolled strip, soft O.H.	4.11c.
*Hot-rolled sheets (8-30 ga.)	3.40c.
Galv. sheets (24 ga.)	4.50c.
Long ternes (24 ga.)	5.50 to 6.20c.
Cold-rolled sheets (20 ga.)	
Standard quality	4.60c.
Deep drawing	4.85c.
Stretcher leveled	5.10c.
SAE, 2300, hot-rolled	7.50c.
SAE, 3100, hot-rolled	6.10c.
SAE, 6100, hot-rolled annealed	10.25c.
SAE, 2300, cold-rolled	8.69c.
SAE, 3100, cold-rolled, annealed	7.29c.
Floor plate, ⅛ in. and heavier	5.43c.
Standard tool steel	12.50c.
Wire, black, annealed (No. 9)	4.65c.
Wire, galv. (No. 9)	5.00c.
Open-hearth spring steel	4.75c. to 10.25c.
Common wire nails, per keg in 25 keg lots	$2.90

*For lots less than 2000 lb.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.55c.
Soft steel bars, rounds and angles	3.60c.
Soft steel squares, hexagons, channels and Tees	3.75c.
Hot rolled strip	3.75c.
Floor plates	5.15c.
Hot rolled sheets	3.50c.
Galvanized sheets	4.50c.
Cold rolled sheets	4.45c.
Cold finished carbon bars	3.80c.

Above prices are subject to deductions and extras for quantity and are f.o.b. consumer's plant within Chicago free delivery zone.

CLEVELAND

	Base per Lb.
Plates	3.55c.
Structural shapes	3.73c.
Soft steel bars	3.50c.
Reinfor. bars (under 2000 lb.)†	2.55c.
Cold-fin. bars (1000 lb., over).	3.80c.
Hot-rolled strip	3.65c.
Cold rolled sheets	4.70c.
Cold-finished strip	3.35c.
Galvanized sheets (No. 24)	4.62c.
Hot-rolled sheets	3.50c.
Floor plates, 3/16 in. and heavier	5.33c.
*Black ann'l'd wire, per 100 lb.	$3.10
*No. 9 galv. wire, per 100 lb.	3.50
*Com. wire nails, base per keg	2.60
Hot rolled alloy steel (3100)	6.05c.
Cold rolled alloy steel (3115)	6.85c.

* For 5000 lb. or less.
† 500 lb. base quantity.
Prices shown on hot rolled bars, strip, sheets, shape sand plates are for 400 to 1999 lb. Alloy steel, 1000 lb. and over; galvanized sheets, 150 to 1499 lb.; cold rolled sheets, 399 lb. and under.

ST. LOUIS

	Base per Lb.
Plates and structural shapes	3.47c.
Bars, soft steel (rounds and flats)	3.72c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	3.87c.
Cold fin. rounds, shafting, screw stock	4.07c.
Galv. sheets (24 ga.)	4.53c.
Hot rolled sheets	3.53c.
Galv. corrugated sheets, 24 ga. and heavier*	4.58c.
Structural rivets	5.02c.

* No. 26 and lighter take special prices.

BOSTON

	Base per Lb.
Structural shapes, 3 in. and larger	5.85c.
Plates, ¼ in. and heavier	3.85c.
Bars	3.98c.
Heavy hot rolled sheets	3.86c.
Hot rolled sheets	4.21c.
Hot rolled annealed sheets	4.76c.
Galvanized sheets	4.76c.
Cold rolled sheets	4.93c.

The following quantity differentials apply: Less than 100 lb., plus $1.50 per 100 lb.; 100 to 399 lb. plus 50c.; 400 to 1999 lb. base; 2000 to 9999 lb. minus 20c.; 10,000 to 39,999 lb. minus 30c.; 40,000 lb. and over minus 40c.

BUFFALO

Plates	3.77c.
Floor plates	5.40c.
Struc. shapes	3.55c.
Soft steel bars	3.60c.
Reinforcing bars (20,000 lb. or more)	2.05c.
Cold-fin. flats, squares, rounds, and hex.	3.80
Hot-rolled sheets, 3/16 x 14 in. to 48 in. wide incl. also sizes No. 8 to 30 ga.	3.50c.
Galv. sheets (24 ga.)	4.50c.
Bands and hoops	3.97c.

NEW ORLEANS

	Base per Lb.
Mild steel bars	4.20c.
Reinforcing bars	3.24c.
Structural shapes	4.10c.
Plates	4.10c.
Hot-rolled sheets, No. 10	4.35c.
Steel bands	4.75c.
Cold-finished steel bars	5.10c.
Structural rivets	4.85c.
Boiler rivets	4.85c.
Common wire nails, base per keg	3.55
Bolts and nuts, per cent off list	60

REFRACTORIES PRICES

Fire Clay Brick

	Per 1000 f.o.b. Works
Super-duty brick, at St. Louis	$60.30
First quality Pennsylvania, Maryland, Kentucky, Missouri and Illinois	47.50
First quality, New Jersey	52.50
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	42.75
Second quality, New Jersey	49.00
No. 1, Ohio	39.90
Ground fire clay, per ton	7.10

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$47.50
Chicago District	55.10
Birmingham	47.50
Silica cement per net ton (Eastern)	8.55

Chrome Brick

	Net per Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester	$47.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	47.00

Magnesite Brick

	Net per Ton
Standard f.o.b. Baltimore and Chester	$67.00
Chemically bonded, f.o.b. Baltimore	57.00

Grain Magnesite

	Net per Ton
Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	$45.00
Domestic, f.o.b. Baltimore and Chester in sacks	40.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	3.40c.
*Structural shapes	3.40c.
*Soft steel bars, small shapes, iron bars (except bands)	3.60c.
‡Reinforc. steel bars, square and deformed	2.61c.
Cold-finished steel bars	4.11c.
*Steel hoops	4.10c.
*Steel bands, No. 12 and 3/16 in. incl.	3.60c.
*Spring steel	4.75c.
†Hot-rolled anneal. sheets	3.40c.
†Galvanized sheets (No. 24)	4.43c.
*Diam. pat. floor plates, ¼ in.	5.00c.

These prices are for delivery in Philadelphia trucking area.
*For quantities between 400 and 1999 lb.
†For 10 bundles or over.
‡For one to five tons.

BIRMINGHAM

	Base per Lb.
Bars and bar shapes	3.50c.
Structural shapes and plates	3.45c.
Hot rolled sheets No. 10 ga.	3.40c.
Galvanized sheets No. 24 ga. or more	4.75c.
Strip	3.65c.
Reinforcing bars	3.50c.
Floor plates	5.83c.
Cold finished bars	4.73c.
Machine and carriage bolts	50 & 10 off list
Rivets (structural)	$4.60 base

On plates, shapes, bars, hot-rolled strip heavy hot-rolled sheets, the base applies on 400 to 3999 lb. All prices are f.o.b. consumer's plant.

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tanks and U. M.	3.60c.	4.00c.	3.40c.
Shapes, standard	3.60c.	4.00c.	3.40c.
Soft steel bars	3.65c.	4.00c.	3.65c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.275c.	open.	2.975c.
Hot-rolled sheets (No. 10)	3.60c.	4.20c.	3.95c.
Galv. sheets (No. 24 and lighter)	5.15c.	4.75c.	4.75c.
Galv. sheets (No. 22 and heavier)	5.40c.	4.75c.	4.75c.
Cold-finished steel			
Rounds	6.55c.	6.60c.	7.10c.
Squares and hexagons	7.80c.	7.85c.	7.10c.
Flats	8.30c.	8.35c.	8.10c.
Common wire nails—base per keg less carload	$3.20	$2.85	$3.00

All items subject to differentials for quantity.

ST. PAUL

	Base per Lb.
Mild steel bars, rounds	4.10c.
Structural shapes	4.00c.
Plates	4.00c.
Cold-finished bars	4.83c.
Hot-rolled annealed sheets, No. 24	4.75c.
Galvanized sheets, No. 24	5.00c.

On mild steel bars, shapes and plates the base applies on 400 to 14,999 lb. On hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over. Base on cold-finished bars is 1000 lb. and over of a size.

DETROIT

	Base per Lb.
Soft steel bars	3.43c.
Structural shapes	3.80c.
Plates	3.75c.
Floor plates	5.42c.
Hot-rolled sheets, 8 to 30 gages above 12 in. and 3/16 in., 24 in. to 48 in. wide	3.58c.
Cold-rolled sheets	4.65c.
Galvanized sheets	4.74c.
Hot-rolled strip, under No. 12	3.83c.
Hot-rolled strip, No. 12 and over	3.58c.
Cold-finished bars	3.85c.
Cold-rolled strip	3.55c.
Hot-rolled alloy steel (SAE 3100 Series)	6.17c.

Quantity extras apply to all items.

. . . NON-FERROUS . . .

. . . Copper sales spurt momentarily as quotations are advanced to 10.25c. . . . May lead demand continues in good volume . . . Spelter sales gain to 5091 tons.

NEW YORK, May 4—The copper market was pulled out of its lethargy last Wednesday when the Phelps Dodge Corp., in a wholly unexpected move, withdrew from the market by advancing its quotations to 10.50c. per lb., Valley delivery. The smelting interests immediately raised their prices from 10c. to 10.25c., while the other producers, who had been at 10.25c., made no change. The unexpectedness of this move, in face of recent declines, brought out heavy buying, and for a while it appeared that the long awaited buying movement was underway. Sales on Wednesday, the day of the advance, were 14,619 tons. But almost suddenly as it had started, buying interest dried up and to all appearances the market is back in the doldrums again. Resale offerings firmed along with the major market, but the change in sentiment over the weekend caused outside prices to slump, with around 10.10c., Valley being asked and 10c. being bid. The export price also rose and fell with the domestic market. From a high of 10.24c., c.i.f., European ports, on Thursday, the price dropped to about 10.10c. this morning.

Lead

Despite the bearishness of the London price, the domestic call for lead continues in good volume, with the sheet lead and pipe, cable, battery and oxide makers especially active. The past week's sales were about 11,000 tons, exclusive of average price business, or 1000 tons better than the preceding week. Prices here are firm and unchanged at 4.75c. per lb., New York, with the London price, which was 3c. this morning, apparently the only obstacle to higher domestic prices.

Zinc

Although on the surface the market appeared very quiet all week, the week's statistics revealed that there had been some fairly good buying. The week's purchases of prime Western metal were 5091 tons against 1199 in the preceding week. Shipments for the week, at 4804 tons, were consistent with the average of the past several weeks. Close to half the week's sales were for May delivery. Domestic quotations are unchanged at 4.89c. per lb., while this morning's London price of 2.82c. per lb. on spot, is a loss of 2c. from a week ago.

Tin

A wave of buying on Friday boosted sales for that day above the 1000-ton mark, but the rest of the week was comparatively quiet. Consumer interest continues to center on nearby metal, a characteristic which traders credit to fear that a war might impede deliveries of tin. Prices advanced to 49.25c. per lb., New York, for prompt Straits, on Friday, the highest since Oct. 22, 1937, and have remained there since.

Non-Ferrous Average Prices

The average prices of the major non-ferrous metals in April, based on quotations appearing in THE IRON AGE, were as follows:

	Per lb.
Electrolytic copper, Conn. Valley	10.47c.
Lake copper, Eastern delivery	10.70c.
Straits tin, spot, New York	47.16c.
Zinc, East St. Louis	4.50c.
Zinc, New York	4.89c.
Lead, St. Louis	4.63c.
Lead, New York	4.78c.

Beryllium Price Cut

Quotations on beryllium copper were reduced $8 to $15 per lb. of contained Be on May 1 by the Brush Beryllium Co., Cleveland. Until 1937 the price was $30 per lb. The new price is the lowest in the history of the metal.

NON-FERROUS PRICES

Cents per lb. for early delivery

	Apr. 26	Apr. 27	Apr. 28	Apr. 29	May 1	May 2
Copper, Electrolytic[1]	10.25	10.25	10.25	10.25	10.25	10.25
Copper, Lake	10.25	10.25	10.25	10.25	10.25	10.25
Tin, Straits, New York	48.50	48.70	49.25	...	49.25	49.25
Zinc, East St. Louis[2]	4.50	4.50	4.50	4.50	4.50	4.50
Lead, St. Louis[3]	4.60	4.60	4.60	4.60	4.60	4.60

[1] Delivered Conn. Valley, deduct ¼c. from New York delivery. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Warehouse Prices

Cents per lb., Delivered

	New York	Cleveland
Tin, Straits pig	50.25c.	52.25c.
Copper, Lake	11.50c.	11.375c.
Copper, electro	11.375c.	11.375c.
Copper, Castings	11.00c.	11.00c.
*Copper sheets, hot-rolled	18.37c.	18.37c.
*High brass sheets	16.65c.	16.65c.
*Seamless brass tubes	19.40c.	19.40c.
*Seamless copper tubes	18.87c.	18.87c.
*Brass rods	12.00c.	12.00c.
Zinc slabs	6.15c.	6.90c.
Zinc sheets, No. 9 casks	10.50c.	12.10c.
Lead, American pig	5.75c.	5.60c.
Lead, bar	6.35c.	8.25c.
Lead, sheets, cut	8.00c.	8.00c.
Antimony, Asiatic	15.00c.	17.00c.
Alum., virgin, 99 per cent plus	22.50c.	22.50c.
Alum., No. 1 remelt., 98 to 99 per cent	19.50c.	19.50c.
Solder, ½ and ½	29.60c.	29.75c.
Babbitt metal, commercial grade	21.50c.	21.75c.

* These prices, which are also for delivery from Chicago warehouses, are quoted with the following percentages allowed off for extras: on copper sheets, 33 1/3; on brass sheets and rods, 40, and on brass and copper tubes, 25.

Old Metals

Cents per lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators. Selling prices are those charged to consumers after the metal has been prepared for their uses.

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	8.00c.	9.75c.
Copper, hvy. and wire	7.00c.	7.50c.
Copper, light and bottoms	6.25c.	6.50c.
Brass, heavy	4.125c.	4.625c.
Brass, light	3.25c.	4.00c.
Hvy. machine composition	6.25c.	7.75c.
No. 1 yel. brass turnings	4.00c.	4.50c.
No. 1 red brass or compos. turnings	6.00c.	6.625c.
Lead, heavy	3.625c.	4.50c.
Cast aluminum	6.50c.	7.75c.
Sheet aluminum	12.25c.	13.75c.
Zinc	2.125c.	3.375c.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered; virgin, 99 per cent plus, 20c.-21c. a lb.; No. 12 remelt No. 2 standard, 19c.-19.50c. a lb. NICKEL, electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt, New York; Asiatic, 14c. a lb., f.o.b.; American, 11.50c. a lb. QUICKSILVER, $94 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 10.50c. a lb.

THIS WEEK'S MACHINE ...TOOL ACTIVITIES...

Further Gain in Domestic Buying Presaged by Inquiries

CINCINNATI—No change was noted in machine tool demand in this area the past week. Attention was largely diverted to European conditions, but little reaction was noted following Hitler's speech, the general feeling being that the general situation has not materially changed. Bookings last week were about equal between domestic and foreign buyers. Domestic interest, however, is being well sustained and, on the basis of active inquiry, further improvement is definitely indicated. Several substantial foreign orders for lathes and millers are reported, but specific information is withheld.

Factory operations are a trifle better with an average of about 60 per cent. Shipments are being delayed in some instances because of inability to produce quickly enough to meet shipping dates.

Aircraft Parts Makers Expanding Their Facilities

CLEVELAND — Three local companies supplying aircraft parts are pushing expansion programs, one firm doubling its space and planning to produce parts which it has not heretofore sold. Both domestic and foreign aircraft activity has been stepped up sharply.

Elsewhere throughout this district the past week has produced moderate sales, but nothing outstanding. A manufacturer of electric drills has purchased several lathes; an electrical firm, a large miller, and a tractor company is after small tools in a hurry. Auto parts makers and similar manufacturers appear quiet.

Chicago Trade Optimistic Though Prospects Indefinite

CHICAGO—The Chicago machine tool market is marking time at present, but even though current sales are far from impressive they are still sufficient to maintain in the minds of most sellers in this area an optimistic outlook for the year as a whole. This attitude is all the more surprising when it is discovered that the trade has very little in mind as concerns future business on which it can definitely count. At the National Machine Tool Builders Association meeting in Chicago last week considerable optimism was expressed, but here again future prospects were mostly intangible. Last week demand for smool tools fell off slightly. The used machinery market continues quiet.

Spotty Conditions Still Prevail in the East

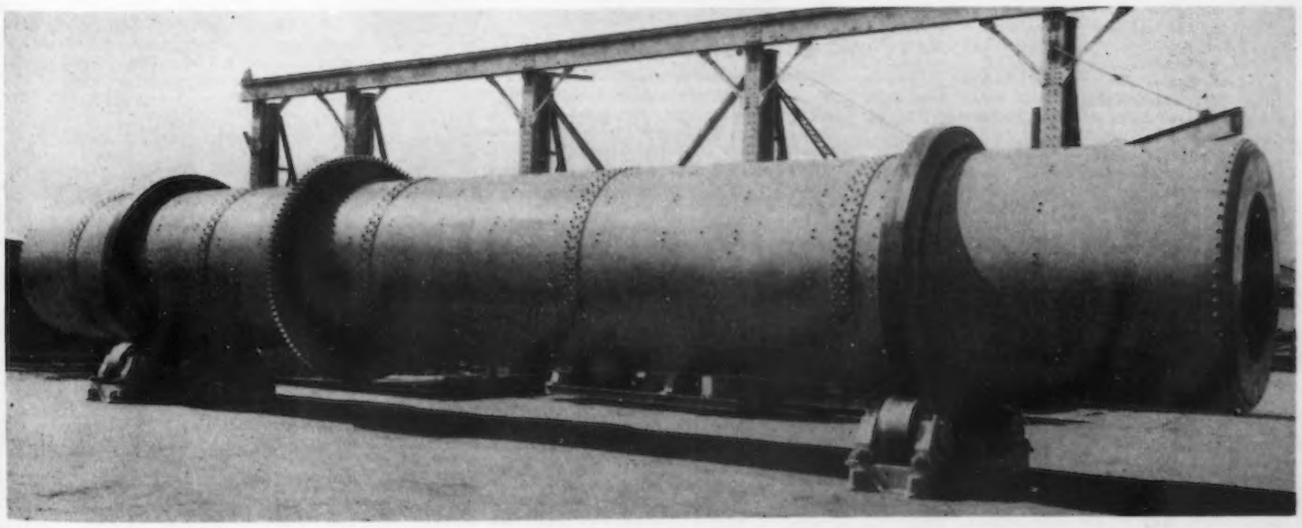
NEW YORK—Sales for the month of April finished with a much better volume than was earlier anticipated, although the local market still remains spotty. For that reason it is difficult to sum up the situation in a phrase that will adequately describe it in a few words. Some dealers are doing business almost solely with concerns that have Government contracts, including aircraft engines and parts and educational orders for the War Department. Others report a fairly well diversified volume of satisfactory proportions. Some direct sellers are doing little or nothing in the way of new business, while one other reports an April volume ahead of that of April, 1937, thus establishing a new record since 1929. The general feeling is that uncertainties at home and abroad are still holding back the latent demand for replacement of machine tools.

Chrysler to Modernize Los Angeles Plant

DETROIT—Along with confirmation of Chrysler plans to modernize and revamp the Los Angeles plant, there comes word that new rust proofing and finishing equipment, conveyors, welders, punch presses and wiring machines will be required. Also new receiving and shipping dock facilities and additional railroad track will be installed. Ford activity, looking toward production of a new tractor in B Building at the Rouge plant, is at a high point following Henry Ford's announcement that production will be started shortly. Progressive Welder Co., Detroit, and affiliates, are erecting three buildings for the manufacture of production welding equipment and accessories. The first of the three structures is already underway.

Manufacturing facilities of Allison Engineering Division of General Motors Corp. in Indianapolis will be increased by approximately 200,000 sq. ft. immediately. The additional plant space will provide more production facilities for the V-type liquid cooled aviation engines now being manufactured by Allison and is understood be have resulted from recent Government orders for approximately 400 of these engines. A considerable amount of new precision machinery has been ordered and will be required for the plant.

AN interesting feature of the design of the dryer illustrated in the accompanying photograph is the 114-tooth cast gear that drives the machine. This gear, cast of Meehanite to secure high wear resistance, was made in dry sand cores in which chills were imbedded. The chills were designed to give a light chill penetration beneath the working surface and to prevent any appreciable chill from forming at the base of the teeth. Checking with a template after casting revealed the gear to be very accurate in pitch diameter as well as in circular pitch and no machining of the teeth was necessary. The gear, with a diameter of 9 ft. 3 in. and an 8 in. face, has a tensile strength of 50,000 lb. per sq. in. The tires and trunions were also cast in Meehanite. The dryer will be used for drying bicarbonate of soda and was made by the Standard Steel Corp., Los Angeles, for the West End Chemical Co., Westend, Cal.



PLANT EXPANSION AND EQUIPMENT BUYING

NORTH ATLANTIC

American Can Co., 230 Park Avenue, New York, has acquired property adjoining branch plant, at Houston, Tex., for one-story addition for storage and distribution. Cost over $75,000 with equipment.

Coca-Cola Bottling Co., Inc., 401 Broad Street, Utica, N. Y., plans new one-story mechanical-bottling plant on Genesee Street. Cost close to $50,000 with equipment. Melvin L. and Harry A. King, Denison Building, Syracuse, N. Y., are architects.

Commanding Officer, Ordnance Department, Watervliet Arsenal, Watervliet, N. Y., asks bids until May 23 for breech ring alloy steel forgings (Circular 213).

Paramount Pictures, Inc., Paramount Building, New York, has acquired about 150 acres bounded by National and Pico Boulevards, Kelton and Overland Streets, Los Angeles, for new studio and plant, to include 20 or more sound stages, machine and woodworking shops, power house, pumping station, large water tanks and other structures. New site will be known as Paramount City. Cost over $10,000,000. Los Angeles offices of company are at 5451 Marathon Street, Hollywood.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 9 for one motor-driven transverse radial drilling machine (Schedule 6172) for Brooklyn Navy Yard; air valves (Schedule 6162) for Brooklyn and Sewall's Point yards; about 200 electric transformers for battleships (Schedule 6060) for Brooklyn and Philadelphia yards.

Oxygen Equipment Mfg. Co., Inc., 247 East Fifty-sixth Street, New York, oxygen tanks and apparatus, has leased space in building at 403 East Sixty-second Street for plant.

State Department of Education, Education Building, Albany, N. Y., will take bids at once, closing on or about June 8, for new power house for central-heating service at school at Fredonia, N. Y., including boiler units, pumps and auxiliary equipment. Fund of about $590,000 has been arranged for this and new school building. W. E. Haugaard is commissioner of architecture, and T. F. Farrell, engineer, both State Office Building, Albany.

Quartermaster Supply Officer, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until May 22 for 500 solid disk type wheels with solid cured-on rubber tires, and 500 load wheels, semi-steel castings, 15½ in. diameter (Circular 626-232).

Hercules Air Filter Service, Inc., 422 East Fifty-third Street, New York, organized to manufacture air filters and air-filtering equipment, has leased space in building at location noted for plant, including department for repair and reconditioning of air filter equipment.

Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until May 9 for cable and eight reels (Circular 230).

Board of Education, 31 Green Street, Newark, N. J., Alfred H. Krick, secretary, asks bids until May 10 for school equipment, including lathes and other tools, metal-working machinery, woodworking machinery, spot welder, cabinet, locker, blue print machine, steam engine, electrical supplies, electric time clocks, steam-fitting supplies, hardware, mechanical office appliances, steel lockers, steel storage and filing cabinets and other equipment.

Lever Brothers Co., 164 Broadway, Cambridge, Mass., soaps, edible oils, etc., plans large one-story addition and several smaller structures to branch edible oil plant at Edgewater, N. J. Cost about $900,000 with equipment. Stone & Webster Engineering Corp., 49 Federal Street, Boston, is engineer.

Commanding Officer, Ordnance Department, Picatinny Arsenal, near Dover, N. J., asks bids until May 8 for one platen balanced press, 2500 lb. capacity (Circular 757), steel grating (Circular 755), copper connectors, solderless connectors, copper lugs, cast iron junction boxes, caulking anchors, wire and cable hangers and other electrical equipment (Circular 763).

Day & Zimmermann, Inc., Packard Building, Philadelphia, consulting engineer, has been engaged by company, now being organized, to make surveys and estimates of cost for modernizing local Cramp shipyard on Delaware River, formerly operated by William Cramp & Sons Ship & Engine Building Co., and closed since 1928. New company plans to take over shipyard and resume shipbuilding operations. It is reported to be headed by Commander Ralph D. Weyerbacker, U. S. N., retired, formerly in charge of naval aircraft factory at Philadelphia Navy Yard.

Commanding Officer, Ordnance Department, Frankford Arsenal, Philadelphia, asks bids until May 9 for gages (Circular 1058).

NEW ENGLAND

Brown & Sharpe Mfg. Co., Providence, R. I., machine tools, small tools, etc., has let contract to J. H. Tower Iron Works, Inc., 50 Borden Street, for structural steel for one-story addition, 62 x 175 ft. Cost over $60,000 with equipment.

Commanding Officer, Ordnance Department, Springfield Armory, Springfield, Mass., asks bids until May 9 for one hydraulic arbor press, with pedestal, motor-driven pump, pressure gage and auxiliary equipment (Circular 419), one plain, cylindrical grinder (Circular 422), seven motor-driven high-speed profilers (Circular 424).

Coca-Cola Bottling Co., 325-35 Shrewsbury Street, Worcester, Mass., has let general contract to Rowley Construction Co., Pawtucket, R. I., for two-story mechanical-bottling plant, 112 x 234 ft. Cost about $175,000 with machinery. Jesse M. Shelton, Atlanta, Ga., is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 9 for four motor-driven arc welding machines and 80 control welding outlet panels (Schedule 6221) for Boston Navy Yard; until May 12, line-type heaters, preheater model with thermotanks and spare parts (Schedule 6112) for Boston, Charleston and Puget Sound yards; rough-machined steel forgings (Schedule 6176) for Boston and Charleston yards; motor-driven, medium-duty engine lathes and spare parts (Schedule 6128) for Portsmouth, N. H., and Mare Island yards.

WASHINGTON DIST.

Civil Aeronautics Authority, New Commerce Building, Washington, asks bids until May 8 for 65 steel towers, insulated antenna, with steel base, insulators, ladders, counterpoise, tuning house supports, etc. (Circular 80), 40 similar steel towers with like accessories (Circular 83).

Julien P. Friez & Sons, Division of Bendix Aviation Corp., 4 North Central Avenue, Baltimore, aeronautical and other scientific instruments and parts, ask bids on general contract until May 8 for new plant on Joppa Road, Towson, where 18-acre tract has been acquired, consisting of main one-story unit, 80 x 400 ft., with wing extension, 100 x 100 ft., and smaller structures. Cost about $500,000 with machinery. Glidden & Baldwin, 513 North Charles Street, are architects; Whitman, Requardt & Smith, West Biddle and Charles Streets, are engineers, both Baltimore.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until May 10 for addition to structural shop at Boston Navy Yard, 100 x 400 ft., with crane runways and rails, monorails, sliding and accordian steel doors, etc. (Specifications 9133); also at same time for one-story addition to shipfitters' shop at Portsmouth, N. H., Navy Yard, 159 x 434 ft. (Specifications 9060).

Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md., asks bids until May 8 for one blower (Circular 385), lead pipe (Circular 388); until May 17, power-driven flanger machine, die feed punch press, roll feed, ratchet dial feed, high-speed disk cut-off machine, and power-driven forming machine (Circular 372), power-driven inclinable punch press with V-belt drive and dial feed (Circular 389).

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 9 for anchor shackles, rope and sail thimbles (Schedule 6111), lead pipe (Schedule 6130); until May 16, screw drivers (Schedule 6182), about 30,000 ship scrapers (Schedule 6183), ratchet braces, breast and hand drills (Schedule 6177), hacksaw frames (Schedule 6170) for Eastern and Western navy yards; until May 12, three corrugated steel boiler furnaces (Schedule 6122) for Norfolk, Sewall's Point and Puget Sound yards; five electric steering gears and spare parts (Schedule 6623) for Norfolk, Charleston and Puget Sound yards; three motor-driven engine lathes (Schedule 6188) for Charleston, S. C., yard.

BUFFALO DISTRICT

General Mills, Inc., Chamber of Commerce Building, Minneapolis, Minn., cereal products, flour, etc., has plans by McEnary & Krafft, Rand Tower Building, Minneapolis, architects, for nine-story branch plant, 76 x 316 ft., on Michigan Avenue, Buffalo, adjoining Washburn-Crosby flour mills, an affiliated interest. Cost about $1,800,000 with equipment. Bids will be asked soon on general contract.

West End Brewing Co., 135 Basin Street, Syracuse, N. Y., has let general contract to Paratore Construction Co., Empire Building, for one-story addition for storage and distribution. Cost close to $45,000 with equipment. Bagg & Newkirk, 256 Genesee Street, Utica, N. Y., are architects. Main offices of brewing company are at Utica.

SOUTH ATLANTIC

J. C. McAuliffe, 796 Wilson Road, N. W., Atlanta, Ga., and associates have plans for new distillery on Milton Avenue, S. W., consisting of several one, two and three-story units for main operating buildings and smaller structures. Cost over $80,000 with equipment. A. Thomas Bradbury, William-Oliver Building, is architect.

Purchasing and Contracting Officer, Quartermaster Corps, Fort Benning, Ga., asks bids until May 10 for steel boiler tubes, expansion joints, steam traps, valves and other equipment (Circular 148-117).

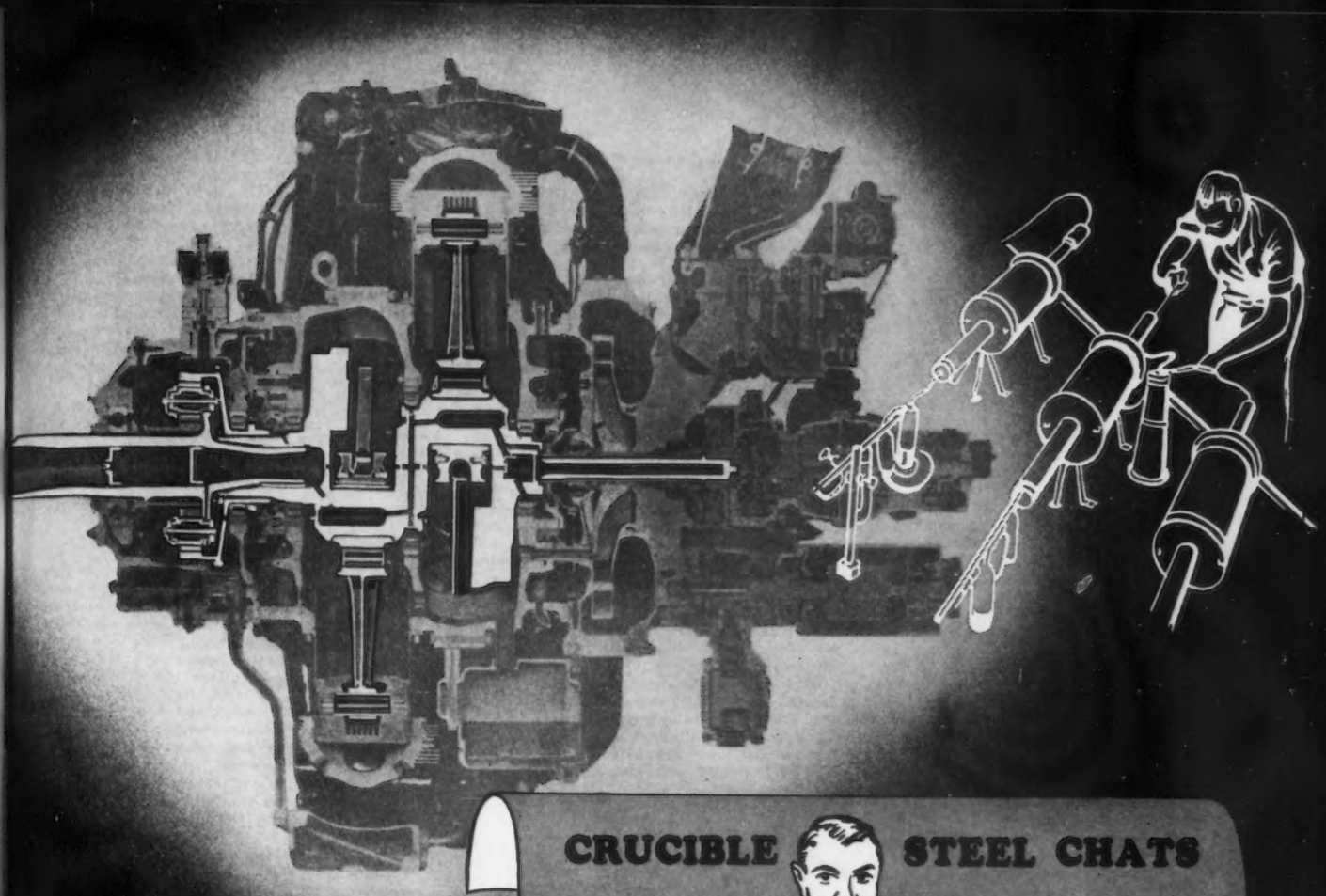
Bureau of Yards and Docks, Navy Department, Washington, will prepare plans soon for new naval air base at Jacksonville, Fla., and seaplane base on Banana River, Fla., to include steel hangars, machine and repair shops, power house and other operating structures. Appropriation of $17,000,000 has been authorized for both projects.

SOUTH CENTRAL

D. C. Jones, Iuka, Miss., is interested in a project to build a local pulp and paper mill for newsprint production, and has donated about 400 acres for plant. It will consist of several one and multi-story units, with power house, pumping station, machine shop and other mechanical departments. Company is being organized to carry out project. Options have been taken on about 20,000 acres of neighboring slash pine timberlands for raw material supply. Cost about $5,000,000, of which approximately $2,500,000 will be secured through loan from RFC, and remainder financed privately. Erection is scheduled to begin this summer. W. L. Goodman of Iuka water and light department is active in project.

United States Engineer Office, Vicksburg, Miss., asks bids until May 11 for two vertical flush head-type marine boilers (Circular 214).

Joseph E. Seagram & Sons Co., Seventh



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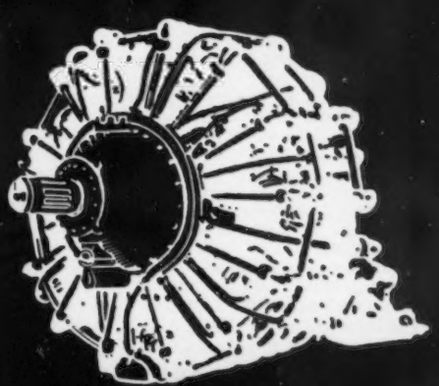
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Street Road, Louisville, has approved plans for one-story addition to distillery for expansion in fermenting division. Cost over $60,000 with equipment. Smith, Hinchman & Grylls, Inc., Marquette Building, Detroit, is architect and engineer.

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until May 12 for oil purifying units for hydroelectric power plant at Hiwassee dam.

SOUTHWEST

Stearman Aircraft Co., Wichita, Kan., plans one-story addition, 100 x 150 ft. Cost over $85,000 with equipment. Overend & Boucher, Brown Building, are architects; Godfrey Hartwell, 1047 West River Boulevard, is engineer.

Warren Petroleum Co., National Bank of Tulsa Building, Tulsa, Okla., has let general contract to Gasoline Plant Construction Corp., 424 North Boulder Avenue, for new natural gasoline plant in Fairbanks oil field district, Harris County, Tex. Installation will include a compressor station, steel tank storage and distribution facilities, power house and other structures. Cost about $250,000 with equipment.

Standard Brands, Inc., 601 N. W. Fifth Street, Oklahoma City, food products, has let general contract to R. H. Dobbins Construction Co., 801 West Noble Street, for one-story factory branch, storage and distributing plant, 75 x 135 ft., at 1732-36 N. W. Fifth Street. A garage and service building for company trucks and cars also will be built. Cost close to $50,000 with equipment. Main offices are at 595 Madison Avenue, New York.

Board of Education, Salina, Kan., plans manual training department in new three-story and basement senior high school. Cost about $600,000. Bond issue has been approved. Benjamin H. Byrnes, National Bank of America Building, and Charles W. Shaver, United Life Building, are architects; Engineering Service Co., Railway Exchange Building, Kansas City, Mo., is consulting engineer.

Board of Directors, Lower Colorado River Authority, Littlefield Building, Austin, Tex., asks bids until May 15 for one 125-ton overhead electric traveling crane for Marshall Ford hydroelectric power plant.

Atlantic Refining Co., 260 South Broad Street, Philadelphia, plans new natural gas recycling plant in Weslaco gas field area, Hidalgo County, Tex., with boiler plant, compressor station, steel tank storage and distributing facilities and other structures. Cost over $500,000 with equipment.

Double Cola Co., 214 Funston Street, San Antonio, Tex., has leased one-story building now being erected at 201 Grayson Street for new mechanical-bottling works. Cost about $80,000 with equipment.

WESTERN PA. DIST.

United States Engineer Office, New Post Office Building, Pittsburgh, asks bids until May 19 for two 36-in., 125-lb. iron body, flanged gate valves, each with hand crank, geared operating mechanism, bypass valve and all parts, for Mahoning dam, near Dayton, Pa. (Circular 616).

Pittsburgh Plate Glass Co., Grant Building, Pittsburgh, plans one-story factory branch, storage and distributing plant at 1545 New York Avenue, N. E., Washington. Cost close to $100,000 with mechanical-handling and other equipment. Maurice S. May and Rhees E. Burket, 726 Jackson Place, N. W., Washington, are architects.

OHIO AND INDIANA

Willard Storage Battery Co., East 131st Street and St. Clair Avenue, Cleveland plans two-story addition, 40 x 300 ft. Cost about $130,000 with equipment. Company is affiliated with Electric Storage Battery Co., Philadelphia.

Board of Education, Barberton, Ohio, has asked bids on general contract for two-story industrial arts building at high school. Cost about $300,000 with equipment. Part of structure will be reserved for a gymnasium. M. P. Lauer, 31 North Summit Street, Akron, Ohio, is architect.

Wooster Rubber Co., Wooster, Ohio, general rubber goods, plans second-story top addition to present one-story plant, 50 x 80 ft. Cost about $45,000 with equipment. R. A. Curry, Wooster, is architect.

Tinnerman Stove & Range Co., 2038 Fulton Road, Cleveland, has let general contract to Austin Co., local, for one-story addition, 50 x 100 ft. Cost close to $50,000 with equipment.

Contracting Officer, Materiel Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until May 8 for galvanized pipe, elbows, tees, gate valves, hose nozzles, etc. (Circular 984); until May 9, 1000 lb. of round enameled magnet wire, double cotton-covered (Circular 962), adjustable pipe wrenches and pipe strap wrenches (Circular 958), propeller blade assemblies, 9 ft. 9 in. diameter (Circular 978); until May 10, cowling fastener studs, cowling fastener flush-type springs, cowling fastener flush-type studs (Circular 967), two contact-type printer assemblies (Circular 969); until May 12, flanged plug four-way valves (Circular 982).

Austin Packing Co., Austin, Ind., food products, plans one-story addition, 200 x 200 ft., for storage and distribution. Cost close to $50,000 with equipment.

Blish Milling Co., Seymour, Ind., has let general contract to MacDonald Engineering Co., 1 North LaSalle Street, Chicago, for addition to flour and feed mill, including nine storage bins, each about 100,000 bu. capacity. Cost over $80,000 with equipment. O. A. Tislow, Architects' & Builders' Building, Indianapolis, is architect.

MICHIGAN DISTRICT

Universal Atlas Cement Co., 208 South LaSalle Street, Chicago, has let general contracts to Muskegon Construction Co., Muskegon, Mich., and Lake States Engineering Co., 111 West Jackson Boulevard, for one-story factory branch, storage and distributing plant at Muskegon. Cost close to $100,000 with equipment.

Continental Motors Corp., 12801 East Jefferson Street, Detroit, gasoline engines and motors, aircraft engines, parts, etc., is arranging for early removal of local plant to branch works at Muskegon, Mich., where production will be concentrated. Company has arranged for sale of issue of 551,348 shares common stock, proceeds to be used in part for plant consolidation and expansion in output at Muskegon.

K. Shapiro, Inc., 1533 Winder Street, Detroit, meat packer, has asked bids on general contract for new one-story plant, 100 x 230 ft., at Vernor Highway and line of Grand Trunk Railway. Cost over $80,000 with equipment. Henschien, Everds & Crombie, 59 East Van Buren Street, Chicago, are architects.

MIDDLE WEST

Chicago Metallic Mfg. Co., 3711 South Ashland Avenue, Chicago, manufacturer of tinware products, has asked bids on general contract for one-story addition, 65 x 100 ft. Cost close to $45,000 with equipment. A. Epstein, 2001 West Pershing Road, is engineer.

Commanding Officer, Ordnance Department, Rock Island Arsenal, Rock Island, Ill., asks bids until May 22 for eight medium full track-laying tractors, powered with 45-hp. gasoline engines (Circular 705).

Coca-Cola Bottling Co., 314 Prairie Street, Rockford, Ill., has let general contract to Gustav Lundin, 414 Paris Avenue, for one-story addition to mechanical-bottling division, 45 x 90 ft. Cost close to $45,000 with equipment. J. A. Barloga, Rockford News Tower Building, is architect.

Quartermaster, Fort Des Moines, Des Moines, Iowa, asks bids until May 12 for one 150,000-gal. elevated steel tank and tower, with piping and accessories (Circular 251-37).

Canby Farmers' Grain Co., Canby, Minn., plans new grain elevator, with 19 bins, 20-ton weighing scale, and other facilities. Cost close to $45,000 with elevating, screening, conveying and other equipment.

Walker Jamar Co., 620 West Fullerton Street, Chicago, manufacturer of sheet metal products, has removed plant to larger space in building at 217 North Jefferson Street, where increased production facilities will be provided. Main offices of company are at Duluth, Minn.

Construction Service, Veterans' Administration, Washington, asks bids until May 23 for steam power equipment for power house at institution at Fargo, N. D., including boiler unit, pumping machinery and accessories.

Howard Aircraft Corp., 5301 West Sixty-fifth Street, Chicago, is considering one-story addition, about 125 x 500 ft. Cost over $175,000 with equipment.

Signal Corps Procurement District, 1819 West Pershing Road, Chicago, asks bids until May 18 for washers, clamps, plugs, clips, spacers and other equipment (Circular 89).

PACIFIC COAST

Lockheed Aircraft Corp., Burbank, Cal., has let general contract to H. W. Baum, 219 West Seventh Street, Los Angeles, for two-story addition, 35 x 150 ft., for storage and distribution. Cost about $60,000 with equipment. John and Donald B. Parkinson, Title Insurance Building, Los Angeles, are architects.

Bureau of Reclamation, Denver, asks bids until May 15 for two 115,000-hp. vertical-shaft hydraulic turbines and two oil-pressure, actuator-type governors, with auxiliary equipment, for Boulder hydro-electric power plant, Boulder Canyon project (Specifications 835); until May 18, three motor-driven pumping units for pumping station No. 1, gravity main canal, Gila project, Gila, Ariz. (Specifications 842).

Columbia Steel Co., Seattle, plans one-story addition, 155 x 420 ft., for storage and distribution. Traveling cranes, hoists and other mechanical-handling equipment will be installed. Cost reported over $100,000 with equipment.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for one 5-ton diesel-electric revolving jib crane, mounted on steel pontoon for Mare Island Navy Yard (Specifications 8975).

Consolidated Aircraft Corp., San Diego, Cal., has let structural steel contract to Consolidated Steel Corp., Los Angeles, for mezzanine floor, 50 x 100 ft., in existing plant unit, for increased production. Cost over $40,000 with equipment. Edward C. and Ellis W. Taylor, 803 West Third Street, Los Angeles, are architects.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 12 for seamless steel flasks for Mare Island, Portsmouth and White Plains yards (Schedule 6114); until May 16, chain hoists for Mare Island and Eastern Navy yards (Schedule 6168); 10 double-drum winches and spare parts for San Pedro, Cal., naval air station (Schedule 6178).

Acting Administrator, Bonneville project, Department of Interior, Portland, asks bids until May 10 for 22,000 lb. of bare wire and cable (Circular 273).

FOREIGN

McEwan & Co., Pty., Ltd., Elizabeth Street, Melbourne, manufacturer of hardware and allied products, and Die Casters, Ltd., Collingwood, manufacturer of die-castings, etc., both Victoria, Australia, have organized a joint subsidiary under name of Metalcraft, Pty., Ltd., to take over hardware-manufacturing business of first noted company, with plant at South Melbourne. Plans are under way for expansion for builders' hardware, etc., including machinery for considerable increase in present capacity.

National Steel Car Corp., Kenilworth Avenue, Hamilton, Ont., has plans for one-story machine shop, 70 x 300 ft. Cost over $200,000 with equipment. Hutton & Souter, 36 James Street, are architects. Company also has recently acquired about 75 acres adjoining present aircraft plant at Malton, near Toronto, Ont., and has authorized several one-story additions to cost about $500,000 with equipment for expansion in parts production and assembling divisions.